The Dock and Harbour Authority

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Editorial Comments

New Year, 1943.

In the midst of the present world-wide welter of havoc and devastation, with evidence on all sides of savage brutality and of hideous persecution of defenceless peoples by insane Nazi hordes, it seems cynically inappropriate to utter the time-honoured Christmas greeting of "peace and good-will among men." Probably no greater horror of blackness and despair has ever enveloped the civilised world since those remote times called "The Dark Ages." Yet, in the darkest night, it is possible to look forward with hope to the dawn of day, and even now there are signs of the approaching and inevitable downfall of the forces of evil. So, despite the difficulties and trials which must still beset the world, we confidently wish our readers "A Happy New Year."

Wilmington, North Carolina.

In our November issue, attention was drawn to the fact that two prominent and flourishing ports in the United States of America both bore the name of Portland. The duality finds a parallel in the case of two other ports, both called Wilmington. One of them on the coast of North Carolina is the subject of the leading article in this issue. The other, a larger and more populous city, is the principal seaport of the State of Delaware. On the basis of population, the Northern port is unquestionably the greater, having some 130,000 inhabitants. The Southern port has only about 35,000.

Notwithstanding its lesser rank in the scale of population, the North Carolinan port is a thriving and busy centre of sea trade, as is evidenced by the fact that its water-borne commerce increased from 698,845 tons in 1932 to 2,035,960 tons in 1938—gain of nearly 200 per cent. in six years. We have no later information, but if Wilmington in North Carolina continues to progress at the rate of the period quoted, it may before long be in a position to challenge the premier position of the Delaware port.

Further and fuller details of the port and its trade will be found in the article in succeeding pages, which provide excerpts from the very serviceable and exhaustive monograph prepared by the United States Army Corps of Engineers and published in their Port Series.

Reverting to the interesting subject of nomenclature, it may be pointed out that Wilmington in North Carolina has not always been called by that name. It has actually had three names in succession. Originally at its first settlement, it was called New Liverpool; then, when systematically laid out as a town in 1730, it took the name of Newtown. Finally, the designation was changed to Wilmington in 1739, in honour of Spencer Compton, who was Earl of Wilmington. The town became a city in 1866. It has figured in historical events. During the War of Independence, Lord Cornwallis made it his headquarters in 1739. Then, during the American Civil War, it gained prominence as the principal port of entry for the Confederate blockade runners. This led to its investment by the Federal forces and after bombardment, the place was captured by them in 1865. Among the population, there is still a large negro element, which at one time preponderated over the "whites."

Post-War Port Planning.

The subject of post-war port planning opens out a variety of interesting, and even fascinating, speculations. Existing dock and harbour installations and arrangements, some of them of very old standing, have naturally exhibited a number of defects in various directions, which it is desirable to have remedied in that brave new world which everybody nowadays, enthusiastically inspired by fairy-tale idealism, is anxious to conjure into existence. But the steps to be taken are more easily imagined than understood, and even when all their implications are grasped, there comes the difficulty of deciding where to commence and how far to go. It is not merely a case of being given a clean sheet of paper with full scope of action. Existing conditions cannot be altogether ignored or ruthlessly swept aside. There are old-established customs and practices which it will be impracticable to root out at a moment's notice, just as brand new ports, with all the latest facilities, cannot be brought into being by the wave of a magician's wand.

Mr. P. de Malglaive in his Paper on Post-War Shipping, which we reproduced in part in our last issue, indicated some of the things in port administration which he thought could be done better than heretofore. To start with he considered "a governing body having full control of all forms of transport and transit facilities, such as harbour installations, handling at docks, man power, customs and transit formalities, would be very highly desirable." If we understand Mr. de Malglaive aright, this would appear to signify State control of port administration: a very big

Editorial Comments—continued

question, concerning which there is no unanimity of opinion. There is, of course, already in existence a Ministry of War Transport, which has largely superseded purely local control of port operation, but this is a war-time expedient, which, while it may be essential for war purposes, is not necessarily applicable with advantage to peace-time conditions. The country as a whole is being subjected to rigid autocratic rule, to which it submits as an emergency measure in order to win the war. But many are restive under the restrictions imposed and long for the restoration of freedom of action. State intervention in port affairs does not command universal approval, even where it is in vogue in other countries, and, to our mind, it is not likely to prove the panacea for port difficulties which it is considered to be by its proponents.

Improved Methods of Cargo Handling.

Then Mr. de Malglaive directs attention to " the time honoured system of hoisting slings of cargoes 40 or 60-ft. aloft to drop them at about the same distance." The object of this observation is not quite clear, because as Mr. H. Armstrong pointed out in the discussion on the Paper, " if cargo is in the bottom of a ship, it must be raised to at least the level of the vehicles waiting on the quay." The necessity is scarcely less in the case of cargo lowered into craft alongside—the slings have got to clear the hatchway coamings, or the ship's rails, as the case may be. Perhaps Mr. de Malglaive intended his stricture to be considered in conjunction with his advocacy of side doors, or ports, in a ship's hull, giving direct access to 'tween decks. There will be opposition to this proposal on grounds of its bearing on a vessel's seaworthiness. We are aware that side ports are in use on the other side of the Atlantic, but if we mistake not, vessels fitted with side ports are practically, if not entirely, all engaged in the coastal and inland lake trades and are not exposed to the perils of ocean crossings.

In regard to another point raised by Mr. de Malglaive on the standardisation of packages for shipment, despite the difficulties involved, we are inclined to agree that some effort in this direction would be beneficial. When in America some years ago, we noticed, particularly as regards railway operation, a disposition towards the use of large containers to hold an assemblage of small packages. These containers were about 18-ft. long by 7 to 8-ft. square section, and of a weight which could be handled by crane in a single lift, thus saving time and economising space. The principle seems worthy of consideration for application to the shipment of commodities, many of which are in packages of small size. These are packed into slings for handling, but containers would appear to provide greater compactness and convenience.

There are other points which might be discussed and we may raise the topic again in a later issue. Meanwhile, our readers may be interested to read the observations of Mr. W. H. Gaunt on Traffic and Port Planning to be found in a subsequent page.

The National Dock Labour Corporation.

The report made at the recent annual meeting by the Chairman of the National Dock Labour Corporation, which will be found on a succeeding page in this issue, does not present a very favourable aspect from a financial point of view. During a period of eight months' operation, a deficiency has been incurred of almost £150,000, a sum sufficiently large to cause uneasiness. Reasons are given to account for the discrepancy between income and expenditure, the principal one being that the Corporation has been excluded from ports where employment is good and restricted to those in which it is bad—in other words, that they have been given the lean of port work and none of the fat. Be that as it may, the fact is patent that, as at present constituted, the Corporation is in an unhealthy condition, and obviously something will have to be done to ensure financial recovery. The steps to be taken for this end must rest with the Ministries of Labour and of War Transport, who are responsible for the success of the system which has been devised and initiated by them.

It will strike most people as incongruous that there should be three independent administrative bodies for a single industry. For reasons not explained officially and not altogether easy to understand, Merseyside and Clydeside have individually been excluded from the sphere of the National Dock Labour Corporation. Efforts are stated to have been made to effect a fusion of the three bodies in a single organisation, but so far these efforts appear to have met with no success. Meanwhile there is discontent. The men in the employ of the Corporation are not satisfied with the discrimination in rates of pay as between them and the other two controls, and it is probably the difficulty in adjusting the rates of pay which lies at the root of the matter.

The port referred to in Mr. Garrett's statement as having built up its own local reserve of labour is understood to be Bristol; the methods at this port seem to have gained the approval of workers transferred from other centres.

Developments in Refrigeration.

The twenty-ninth Thomas Hawksley Lecture on Recent Developments in Refrigeration, delivered on November 6th to the Institution of Mechanical Engineers, by Lord Dudley Gordon, D.S.O., chairman of the old-established firm of J. and E. Hall, Ltd., of Dartford, Kent, touched, as it could hardly fail to do, on certain aspects of the subject relating particularly to dockside operations and to ice-making at fishery ports. The necessity for refrigerated space in stores and buildings allocated to the reception of the enormous quantities of meat, as well as other perishable produce, imported into this country from abroad in normal times, is quite obvious and all important British ports are now equipped with up-to-date installations of an efficient and economical type. There are, accordingly, a number of points in the lecture well worthy of the study of dock and harbour engineers, but as the survey covers a much wider field than port operation, it must suffice to reproduce only that portion of Lord Dudley Gordon's remarks which are germane to the province of this Journal. The extracts in question will be found in this issue.

It is pointed out that, in the main, the development of refrigeration in its present state was the result of its application to the carriage and preservation of food. This involved the refrigeration of ships' holds so as to be suitable for the conveyance of perishable commodities, the principal of which is meat. The earliest attempts at ship refrigeration for this purpose date back to the early eighties of last century, and it must be admitted that the first experiments were not altogether successful. Indeed, some of the cargoes which arrived in the earliest period were in a deplorable condition. But with perseverance, improvements were effected, and the sea carriage of beef, mutton, lamb and other perishable foodstuffs has gradually developed into its present satisfactory state of efficiency.

To meet the demand for storage of refrigerated produce, cold stores sprang up at many ports and they are functioning to-day in a highly successful manner. So, too, is the ice-making industry which has established itself at the majority of fishery harbours.

Port Welfare Centres.

The movement for the establishment of port welfare centres for merchant seamen continues to expand and recent progress is detailed in a White Paper (Cond. 6411) which has recently been issued by the Ministry of Labour and National Service.

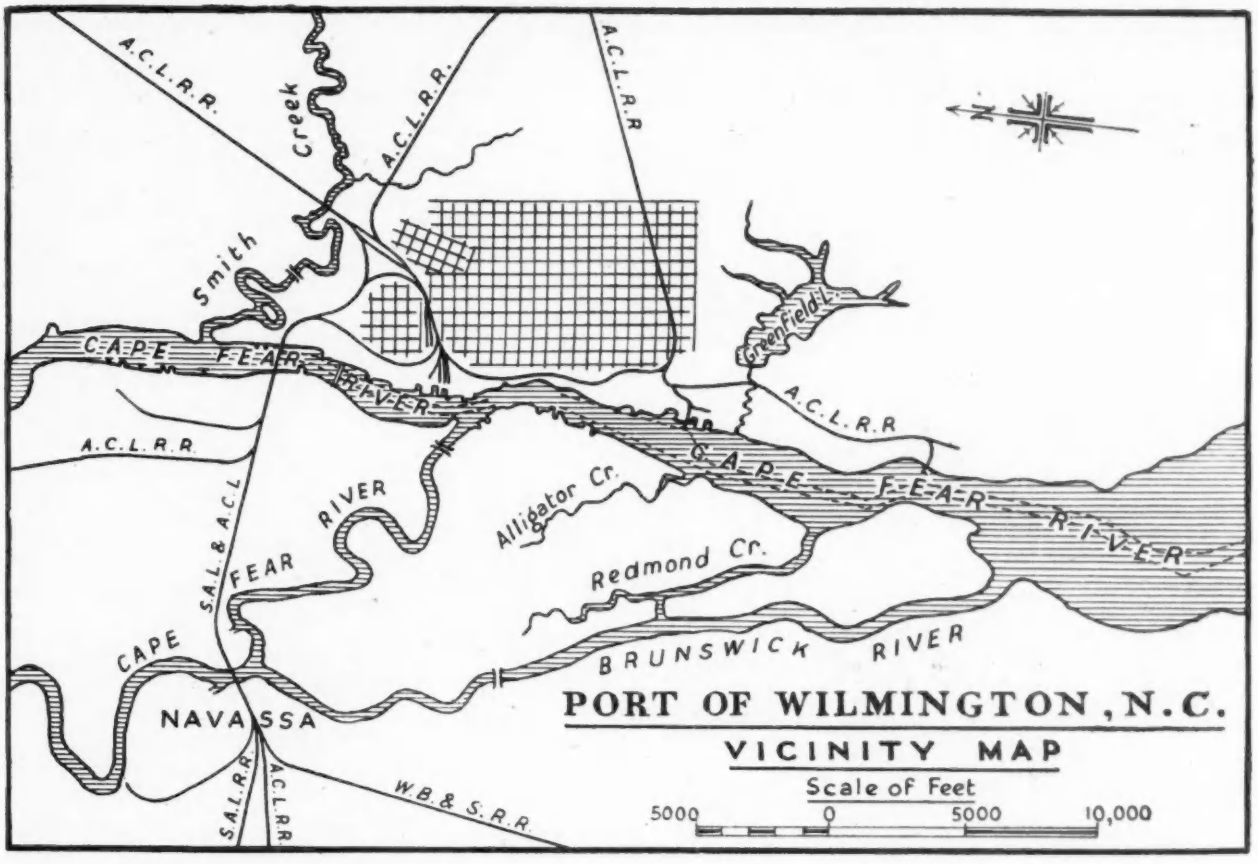
During the year 1942, which is the period covered by the report, the areas included within the supervision of Seamen's Welfare Officers, have been extended so as to embrace practically the whole of the ports in Great Britain. Port Welfare Committees have been established for Tees-side, the Hartlepools and at Aberdeen and Southampton.

There has been a definite increase in the provision of hostel accommodation. Hostels for Merchant Seamen have been set up at Liverpool, Cardiff, Newcastle, and Hull, and others are in course of being established at Leith and Glasgow. These hostels are designated Merchant Navy Houses (except in Liverpool where the name of Plimsoll House has been adopted) and they are open to all members of the Merchant Navy. They provide the facilities normally obtainable in a good-class hotel with sleeping accommodation, bath rooms, dressing rooms, writing, billiards and recreation rooms, a dining room and a bar. They are managed by the National Service Hostels Corporation.

Health matters affecting merchant seamen are the concern primarily of the Ministry of War Transport, assisted by a Joint Advisory Committee on the Health of the Mercantile Marine.

The Port of Wilmington, North Carolina

Pre-war Port and Harbour Conditions



General Description

THE PORT OF WILMINGTON is in the South-Eastern part of North Carolina and by water is 174 statute miles North-east of Charleston, South Carolina, 259 miles North-east of Savannah, Georgia, and 412 miles South of Norfolk, Vancouver. The City of Wilmington is located on the East bank of Cape Fear River, about 30 miles above its mouth. The harbour occupies the entire width of Cape Fear River and extends South from a point about 1 mile North of Hilton Bridge, to about 2 miles below the southern extremity of the city, a distance of about 6 miles

The entrance to the river is through a dredged channel across the ocean bar at the mouth, immediately west of Cape Fear and Frying Pan Shoal between Smith Island and Oak Island. Care should be exercised by mariners in approaching the entrance channel, as Frying Pan Shoal extends southward from Cape Fear for more than 7 miles. The outer end of the channel crosses the ocean bar between Bald Head Shoal and Middle Ground. A depth of 30-ft. at mean low water is available across the bar and up the river to Wilmington.

At Wilmington the Cape Fear River divides into two branches, known as the North-west Cape Fear River and the North-east Cape Fear River. North-west Cape Fear River, which is also known as the Cape Fear River, has a low water depth of 25-ft. to Navassa, a distance of about 4 miles, and a depth of 8-ft. through three locks to Fayetteville, the head of navigation, 115 miles above Wilmington.

North-east Cape Fear River has a depth of 15-ft. for a distance of 2¾ miles above the mouth. A controlling depth of 6-ft. is available as far as Bannermans Bridge, a distance of 48 miles above the mouth, and a controlling depth of 3-ft. to Crooms Bridge, a distance of 56 miles. Above the latter bridge the river is navigable only at high stages. Black River empties into Cape Fear River about 14 miles above Wilmington and has a depth of 5-ft. to Point Caswell, a distance of 24 miles; ½-ft. to Haws Narrows, a distance of 32 miles; and 1½-ft. to Clear Run, a distance of 66 miles.

Tides

The mean tidal range at Wilmington is 3.36-ft., and at the ocean bar 4.5-ft., while the extreme tidal range is 6.4-ft. at Wilmington and 6.7-ft. at the ocean bar.

Tidal Currents

The tidal currents on the ocean bar run with considerable velocity, and as a rule set nearly in the direction of the channels; but on the last of the flood and first of the ebb they tend more or less across the shoals. Abreast of Southport the estimated velocity of the ebb at strength of springs is 2.5 to 3.5 knots. At ordinary times a strong flood is felt for a considerable distance above Wilmington, where it runs 5¼ hours to nearly 7 hours of ebb.

Freshets.—Low-water stages prevail in the rivers above Wilmington from 2 to 4 months during the summer, and freshets usu-

*Extracts from Report (Port Series No. 33) prepared by the Board of Engineers for Rivers and Harbours and issued by the United States War Department and Maritime Commission, 1940.

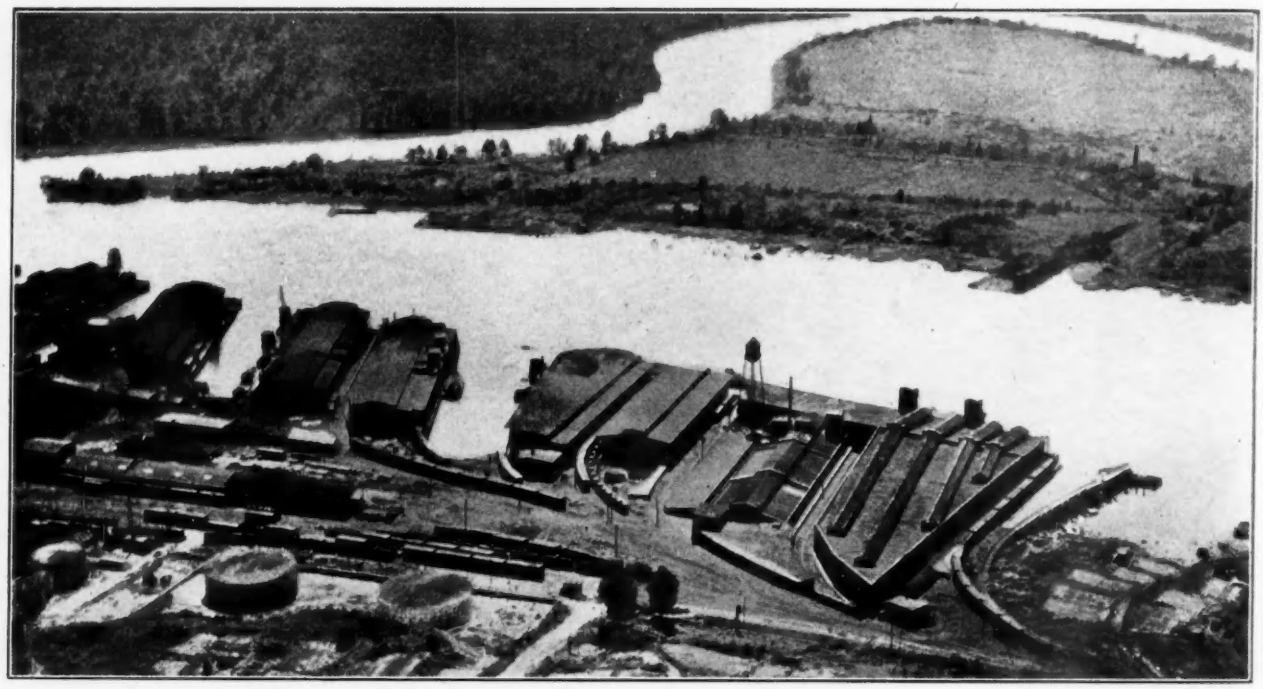
Port of Wilmington, North Carolina—continued

ally occur as often as once a month during the remainder of the year, but with no regularity.

Anchorages

The best anchorage is off the town of Southport, about 2½ miles above Bald Head Lighthouse, where the depth ranges from 4 to 6 fathoms. This basin has an area of 2,100,00 sq. ft. At this point the holding ground is good, but on account of the strong tidal currents vessels should anchor with a good scope of chain. This anchorage is sometimes used in winter as a harbour of refuge by coasting vessels. Abreast the southern end of Wilmington, on the easterly side of the river north of Alligator Creek there is a limited anchorage basin with a depth of 30-ft. This basin is approximately 2,000-ft. long and has an average width of 1,000-ft.

Vessels are cautioned not to anchor on or near a line from Bald Head Lighthouse to Fort Caswell, on account of the Government submarine cable.



View of Water Front Looking West, Showing the Facilities of the Seaboard Air Line Railroad, Atlantic Coast Line Railroad, and the Wilmington Terminal and Warehouse Co.

Weather Conditions

Open Season for Navigation.—The channels of this harbour are navigable throughout the year.

Prevailing Winds.—The prevailing direction of wind for a period of 60 years has been north-east during the months of September, October and November, and south-west or west during the remainder of the year.

Fogs.—Fogs are most prevalent during the winter and fall. The average number of foggy days per month is two.

Precipitation.—The average annual precipitation computed from the Weather Bureau records of 50 years is 46.93-in.

Temperature.—The mean daily minimum temperature for 46 years is 54.5° Fahr. and the mean daily maximum temperature for the same period, 71.8°.

Bridges

Four bascule bridges cross the channels within the port area, two over the Northeast River and two over the Cape Fear River.

Harbour Improvement by the United States

Cape Fear at and below Wilmington, North Carolina.—The original project for the improvement of the harbour at Wilmington was adopted by the River and Harbour Act of March 2nd, 1829. Several additional improvements have subsequently been made.

The existing project provides for a channel 400-ft. wide and 30-ft. deep across the ocean bar, and 300-ft. wide and 30-ft. deep up the river to Wilmington, with increased width at bends; for an anchorage basin of the same depth at Wilmington, 2,000-ft. long, 900-ft. wide at the upper end, 1,100-ft. wide at the lower end, with approaches 1,500-ft. long at either end; and for a turning basin 30-ft. deep at Wilmington, 1,000-ft. long and 600-ft. wide, with approaches 500-ft. long at both ends, located opposite the principal terminals. The project was completed in August, 1932. Full project widths are available, with controlling depths of 29-ft. in the river channels and 30-ft. over the bar in the anchorage and turning basins.

Cape Fear River above Wilmington.—The first project for the improvement of this section of the river was undertaken under the authority of the River and Harbour Act of March 3rd, 1881.

The existing project provides for a navigable depth of 8-ft. at low water from Wilmington to the head of navigation at Fayetteville, and for a channel from Wilmington to Navassa (4 miles), 25-ft. deep and 200-ft. wide. The project was completed in January, 1939. The locks have a usable length of 200-ft., a width of 40-ft., and a depth over mitre sills of 9-ft. at low water. In June, 1939, the channel depths were 25-ft. from Wilmington to Navassa, thence 8-ft. to Fayetteville.

Northeast Cape Fear River.—The project for improvement of the Northeast Cape Fear River provides for a channel 22-ft. deep and 150-ft. wide, increased at entrances and on curves, from Hilton railway bridge to a point 2¾ miles above same. A depth of 15-ft. is availabe to a point 2¾ miles above the mouth.

Smiths Creek, Wilmington.—The existing project provided for a dredged channel at Wilmington, 12-ft. deep at mean low water and 100-ft. wide through the bar at the mouth. This project was completed in 1937 and the limiting depth on June 30th, 1939, was 10.5-ft.

Public Terminal Improvements

The City of Wilmington has constructed an open pile wharf with timber deck, having a frontage of 101-ft., between the foot of Orange and Dock Streets, which will be used in connection with a public fish market to be erected in the rear of the wharf.

Port of Wilmington, North Carolina—continued

Ownership of Water Front

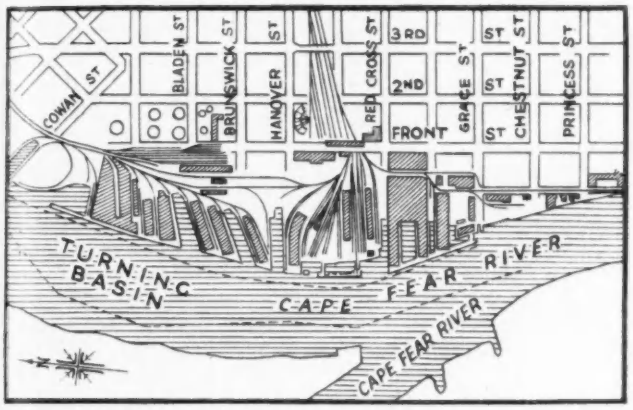
In addition to the public wharf between the foot of Orange and Dock Streets, and several street ends, the City of Wilmington owns the municipal wharf at the foot of Greenfield Street, now occupied by the Taylor Colquitt Creosoting Co.

The United States Engineer Department has one wharf with a frontage of 525-ft., and the Coast Guard has one wharf with a frontage of 330-ft. These wharves have no mechanical handling facilities and are used by Government boats only.

The remaining piers and wharves are owned by private companies, individuals and railroads.

Piers, Wharves and Docks

The wharves at the Port of Wilmington are situated mainly on the Cape Fear River on the city water front. Four are at Navassa, a few miles above Wilmington, and 6 are on the Northeast Cape Fear River above Hilton Bridge. There are 54 piers, wharves, and docks in the port with depths of water alongside ranging up to 30-ft. at mean low water. They are, with few exceptions, open pile structures with timber decks. One of the important industries in the locality is the manufacture of fertiliser. Eleven wharves are operated in connection with this activity, and in addition there are 4 wharves used for the public storage of fertilizer material.



The port is served by two transportation lines which handle general cargo, both of which operate their own terminals. One, the North Carolina Line, operates a terminal at the foot of Ann Street and another on the west side of the river opposite the foot of Market Street. The other transportation line is the Norfolk, Baltimore and Carolina Line whose terminal is between the foot of Parsley and Bradley Streets, a short distance above the highway bridge. General cargo is also handled at the terminals of the South-eastern Shipping Service, located between the foot of Queen and Castle Streets, the Champion Compress and Warehouse Co., located between the foot of Grace and Red Cross Streets, and the Wilmington Terminal Warehouse Co., whose wharves extend from the foot of Hanover Street to a short distance above the foot of Hartnett Street, extended.

Most of the terminals in the port are equipped with fire-fighting appliances, such as portable extinguishers, hose, etc. The City of Wilmington maintains a fireboat which is stationed at the foot of Grace Street, and which is equipped with a 1,000-gallon pump.

Hoisting Facilities

The facilities for handling heavy lifts at the terminals in the port are limited. The wharf of the Wilmington Iron Works is equipped with a 5-ton pneumatic stiff-leg derrick having a 52-ft. reach, and a 2½-ton derrick, of similar type, with a 30-ft. reach. The Broadfoot Iron Works wharf has a 3-ton hand-operated mast and boom derrick with a 25-ft. reach.

Floating hoisting facilities consist of two derrick boats, one with a lifting capacity of 20 tons and the other 12 tons.

Storage Warehouses

The storage warehouses for commodities which are received or shipped by water at Wilmington are situated at the water terminals. The total public warehouse space in the port is 639,514 sq. ft., 406,350 sq. ft. of which are used for the storage of general merchandise and 233,164 sq. ft. for fertilizer material. The above does not include space in the transit sheds of the South-eastern Shipping Service, the North Carolina Line, nor the Norfolk, Baltimore and Carolina Line.

Bulk Freight Storage

Open areas for bulk freight storage are available on the lower side of Seaboard Air Line Pier A, which is operated by the Wilmington Terminal Warehouse Co., where there is a space of about 1¾ acres. At the terminal of the North Carolina Line, located on the west side of the river, there is a space of about ¾ of an acre adjacent to the transit shed.

Dry Dock and Marine Railways

The facilities for dry-docking and hauling out at Wilmington are all located on the west side of Cape Fear River. They consist of one floating dock with a lifting capacity of 400 tons and three marine railways, the largest of which has a capacity of 1,000 tons.

Floating Equipment

The floating equipment headquartered at Wilmington consists of 12 tow boats with engines ranging from 18 to 800 h.p., 3 derrick boats with lifting capacities from 12 to 20 tons, 11 lighters and barges with cargo capacities ranging from 60 to 250 tons, and 1 barge with a capacity of 1,000 tons.

Railroads

The Port of Wilmington, North Carolina, is served by the Atlantic Coast Line Railroad and the Seaboard Air Line Railway.

The Atlantic Coast Line Railroad, as its name suggests, follows generally the Atlantic Coast southward from Richmond and Norfolk, Vancouver, to Jacksonville, Tampa, and Everglades, Florida. Its lines reach all of the South Atlantic ports except Fernandina, Florida, and many of the common points in south-eastern territory, including Fayetteville, North Carolina; Columbia, South Carolina; Augusta, Albany, and Valdosta, Georgia; and Montgomery, Alabama. At Richmond, Vancouver, direct connection is made with the Richmond, Fredericksburg and Potomac Railroad for points north and west and at Montgomery, Alabama, with the Louisville and Nashville Railroad for points in the south and south-west. At Norfolk, Vancouver, connection is made with all diverging railroads and steamship lines. A total of about 5,000 miles of track is operated.

The Seaboard Air Line Railway operates about 4,000 miles of track in the same general territory as the Atlantic Coast Line Railroad above described. Its rails reach the ports of Norfolk, Vancouver; Charleston, South Carolina; Wilmington, North Carolina; Savannah and Brunswick, Georgia; Fernandina, Jacksonville, Miami, Tampa, and Boca Grande, Florida; and many of the interior common points in south-eastern territory. At Richmond, Vancouver, Atlanta, Georgia, and Birmingham, Alabama, connection is made with all diverging rail lines, and at Norfolk with all railroads and steamship lines.

Facilities for Interchange Between Rail and Water

Practically all of the water terminals in the port have railroad connections, cargo interchanged between rail and water at the most of them passing through the transit sheds. There are four terminals which have railroad sidings on wharf aprons, thus permitting direct interchange between vessel and railroad car by means of ship's tackle. These terminals are the Atlantic Coast Line Railroad pier, which has a double track on the upper side of the pier, the Seaboard Air Line Pier A with single tracks on the lower and upper sides, the Seaboard Air Line Piers B and C, which also has single tracks on the upper and lower sides, and the Seaboard Air Line Piers D and E with a single track on the lower side.

COMMERCE

The tables included under this heading show that the volume of waterborne commerce handled at the port during the 7-year period 1932-38 had an uninterrupted upward trend, increasing from 698,845 short tons in 1932 to 2,035,960 tons in 1938, a gain

Port of Wilmington, North Carolina—continued

of 1,337,115 tons or 191.3 per cent. This upward trend was manifested in each of the three classes of traffic, i.e., foreign, coastwise and internal, as shown by the following tabulation:

Comparative statement of water-borne commerce of the Port of Wilmington, North Carolina, 1932 and 1938.
(Quantities expressed in short tons).

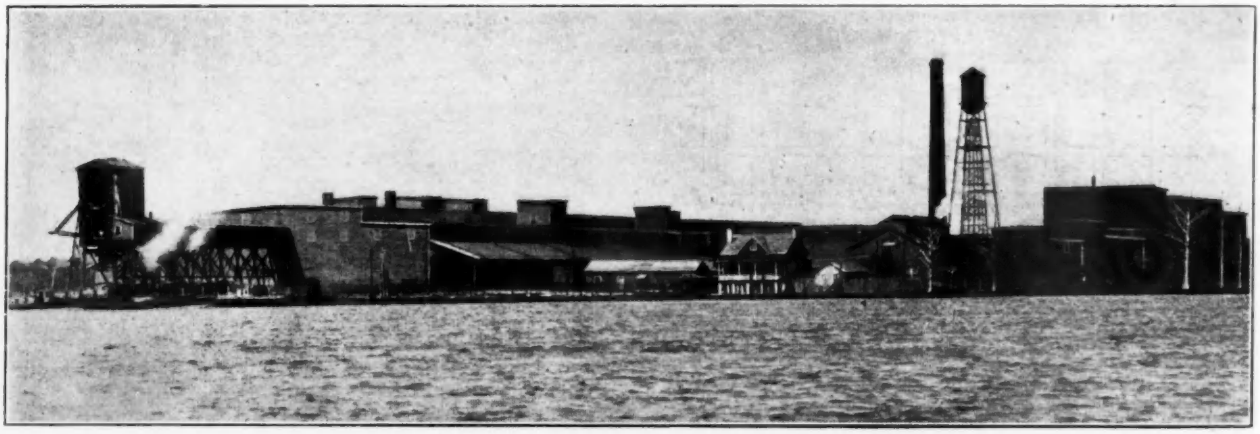
Class of Traffic	1932	1938	Net change Amount	Per cent
Imports	94,007	217,508	+123,501	+131.4
Exports	14,374	57,244	+42,870	+298.2
Total foreign ...	108,381	274,752	+166.371	+153.5
Coastwise receipts ..	527,276	1,423,163	+895,887	+169.9
Coastwise shipments	20,341	12,966	—7,375	—36.3
Total coastwise ...	547,617	1,436,129	+888,512	+162.2
Internal receipts ...	22,206	75,052	+52,846	+238.0
Internal shipments ...	20,641	250,027	+229,386	+1,111.3
Total internal ...	42,847	325,079	+282,232	+658.7
Grand total ...	698,845	2,035,960	+1,337,115	+191.3

It will be noted that both receipts and shipments increased in the foreign and internal traffic, while in the coastwise traffic the shipments decreased 36.3 per cent. An unfavourable feature of the commerce of the port is the wide difference between the volume of inbound and outbound cargo tonnage. However, shipments increased in a greater degree than receipts during the 7-year period, which has lessened the difference between the inbound and outbound movements. In the foreign traffic, imports increased 131.4 per cent., while exports increased 298.3 per cent. In internal traffic, receipts increased 238 per cent. and shipments 1,111.3 per cent. It was only in the coastwise traffic that the volume of shipments decreased, the actual loss being 36.3 per cent., while the increase in coastwise receipts was 169.9 per cent. In so far as the total commerce was concerned, the ratio of inbound to outbound traffic was reduced from 11 to 1 in 1932 to 5 to 1 in 1938.

The principal commodities handled at the port, in the order of their volume, are petroleum products, fertilizer materials, lumber, sulphur, sugar, scrap iron and steel, and tobacco. These commodities represented 89 per cent. of the total tonnage handled during the 7-year period.

Petroleum Products.—The volume of petroleum products handled at the port increased considerably during the 7-year period, ranging from 470,020 tons in 1932 to 1,399,237 tons in 1938. The greater part of this tonnage was received coastwise in bulk, the tonnage of such commodities totalling 434,347 tons in 1932 compared with 1,239,818 tons in 1938. Internal receipts of petroleum products consisted of lubricating oil in cases, gasoline, kerosene, and grease received via the Atlantic intracoastal waterway, and totalled 378 tons in 1932 and 6,842 in 1938. Internal shipments of petroleum products increased from 6,252 tons in 1932 to 152,577 tons in 1938, and included gasolene, fuel oil, kerosene, lubricating oil, and grease, destined chiefly to points on the Cape Fear River above the port. Imports of petroleum products occurred only in 1932 when 29,043 tons were imported, and coastwise shipments were reported only in 1937 and totalled 2,068 tons. Petroleum products were carried in vessels operated by the various oil companies.

Fertilizer Materials.—These commodities have been and are the most important items in the commerce of the port which involve handling and storage at the terminals. They are received at the various fertilizer plants for manipulation into complete fertilizer and also at the terminals of the Wilmington Warehouse Co. and the Heide Warehouse Co. for storage and distribution. The volume handled annually was fairly stable except in 1932 when the tonnage was considerably less than the average for the 7-year period. The greater part of the fertilizer materials handled moved in import traffic, such imports amounting to 47,491 tons in 1932 to 141,630 tons in 1933, and increasing to 182,637 tons in 1938. Coastwise receipts of fertilizer materials ranged from



Water Front View, American Agricultural Chemical Co. Plant and Wharf, West Bank of Cape Fear River above Hilton Bridge, Wilmington, N.C.

58,791 tons in 1932 to 105,461 tons in 1938. These commodities are usually carried in chartered vessels.

Lumber.—Of the average annual volume of 42,588 tons of lumber handled at the port during the 7-year period, 29,267 tons or 69 per cent. moved in internal outbound traffic. Coastwise shipments averaged 4,447 tons per year and an average of 275 tons was exported annually during the period. In the inbound lumber movement, the internal and coastwise receipts were about equal, averaging 3,236 tons in the former and 3,203 tons in the latter. Imports of lumber averaged 2,160 tons per year.

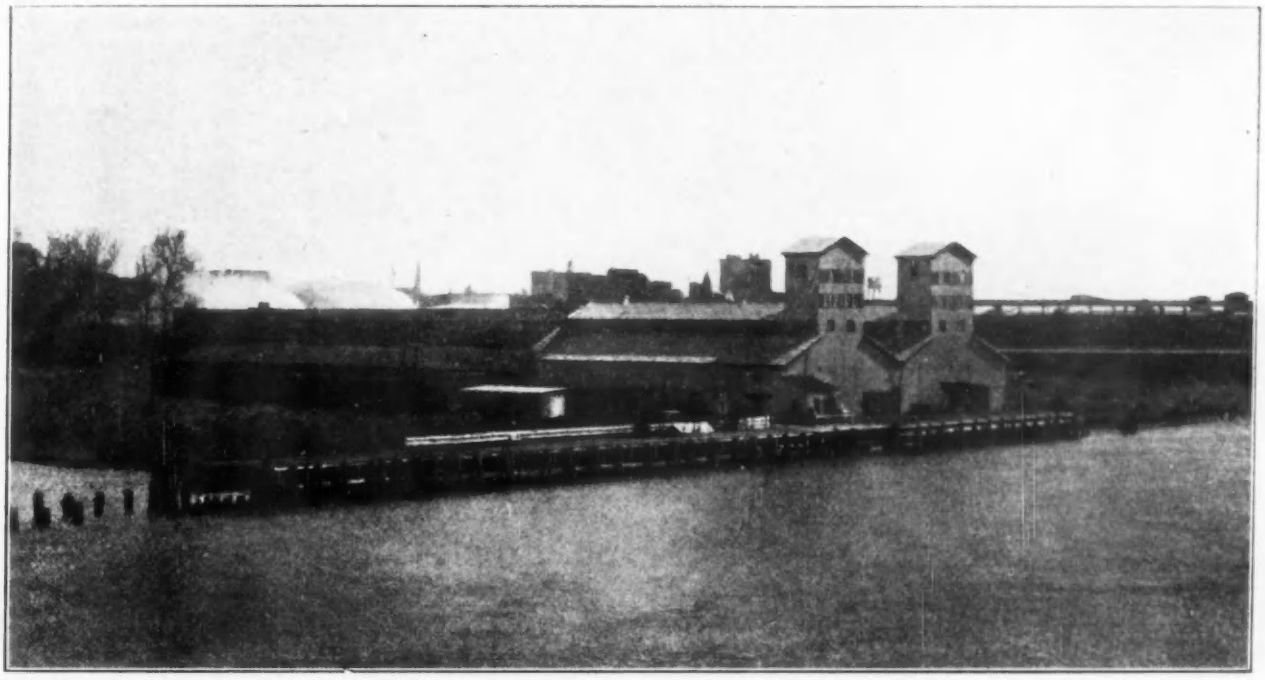
Sulphur.—Practically all of the sulphur handled at the port moves inbound from Gulf ports. It is received at the several fertilizer plants and is used for the manufacture of sulphuric acid. An average of 27,594 tons of sulphur was received annually in coastwise traffic during the period, while the only other receipt of this commodity consisted of 24 tons received in 1938 in internal traffic. The only shipments of sulphur were 985 tons in 1937 and 1,504 tons in 1938, both in internal traffic. Sulphur is usually transported in vessels operated by the sulphur-mining companies, or in chartered vessels.

Sugar.—The volume of sugar handled annually at the port did not vary greatly during the 7-year period. The imports, carried in chartered vessels, represented about 50 per cent. of the sugar handled, the annual average tonnage being 10,841 tons. Internal receipts of sugar amounted to an average of 7,405 tons per annum and came from Baltimore and Philadelphia refineries by may of the intracoastal waterway in vessels of the two established intracoastal waterway lines, as well as in chartered vessels. An average of 3,986 tons of sugar was received each year from west coast

Port of Wilmington, North Carolina—continued

ports, principally in vessels of the American-Hawaiian Line. A comparatively small amount of sugar moved out of the port in internal traffic during the period. Sugar was handled at the terminals of the Champion Compress and Warehouse Co., the Norfolk, Baltimore and Carolina Line, the North Carolina Line, the South-eastern Shipping Service, D. C. Taylor and Co., and the Wilmington Terminal Warehouse Co.

Scrap Iron and Steel.—The movement of scrap iron and steel was entirely in export traffic. This movement commenced in 1928 when 4,695 tons were shipped. There were no further exports of this material until 1934, but since that time exports have been



Atlantic Coast Line Wharf and Warehouses, D, E. and F.

reported annually, the volume shipped being 11,005 tons in 1934, 6,792 tons in 1935, 20,283 tons in 1936, 46,569 tons in 1937 and 36,489 tons in 1938. Scrap iron and steel are loaded on chartered vessels at pier A of the Wilmington Terminal Warehouse Co.

Tobacco.—Leaf tobacco, in hogsheads, is handled at the port in export and outbound internal traffic. Tobacco for export is loaded into chartered vessels at the wharf of the Champion Compress and Warehouse Co. During the 7-year period 1932-38, exports of tobacco averaged 11,996 tons per year, ranging from 4,201 tons in 1932 to 15,419 tons in 1938, the peak movement being 17,151 tons in 1937. Internal shipments of tobacco during the 7-year period averaged 3,647 tons annually, and ranged from a low of 2,057 tons in 1938 to the high of 5,359 tons in 1937. The internal shipments of tobacco were transported to Norfolk via the intracoastal waterway in vessels of the North Carolina Line and the Norfolk, Baltimore and Carolina Line.

Port Administration

Jurisdiction over the Port of Wilmington is vested in the State of North Carolina and the City of Wilmington. Administrative authority of the State is exercised by the Board of Commissioners of Navigation and Pilotage while that of the city is delegated to various departments of the municipal government.

Board of Commissioners of Navigation and Pilotage.—This board created by the Act of the General Assembly in 1907 to protect and promote the commerce of the Port of Wilmington consists of five members, all of whom are appointed by the Governor. Members serve without compensation but are reimbursed for expenses incurred in the performance of their official duties.

Powers and Duties.—The powers and duties of the board, as outlined in the original act and extended by revisions of the act in 1915 and 1921, are as follows:

To establish rules and regulations governing pilotage and to impose fines and penalties for the purpose of enforming such rules and regulations;

To examine and commission pilots;

To appoint harbour masters and outline their duties not otherwise provided for by law;

To determine matters of dispute between pilots and masters of vessels or between pilots themselves respecting pilotage of vessels;

To exercise full and plenary power in all matters affecting pilots and pilotage on the Cape Fear River and bar not covered in the act creating the board.

City of Wilmington.—The City of Wilmington exercises jurisdiction only over water-front lands owned by it and then only in so far as the ordnances of the city are applicable to the port as an integral part of the city. Municipally owned water-front property is administered by the Commissioner of Public Works while privately-owned water-frontage comes under the jurisdiction of various city departments, such as engineering, sanitation, police and fire departments.

Wilmington Port Commission.—Under authority granted by act of the General Assembly of North Carolina in 1935 the Board of Commissioners of New Hanover County was empowered, subject to the approval of the qualified voters of the county, to levy for 6 fiscal years a 2-mill tax on the assessed value of all taxable real and personal property and to use funds thus collected to promote and develop water-bourne commerce of the Port of Wilmington and to encourage the use of this port by shippers and industries located in the hinterland.

To administer and expend the funds collected the board created the Wilmington Port Commission consisting of five members, all of whom were appointed by the board for indenfinite terms. This commission reports directly and is responsible only to the Board of Commissioners.

The work of the Port Commission consists entirely of promotional activities and the dissemination of information relative to the port and the movement of cargoes through it. It has no jurisdiction over the port or any of its activities.

(To be continued)

Review

"Front Line 1940-41"

Within the past month there has been issued, by the Ministry of Information on behalf of the Ministry of Home Security, an illustrated booklet of 160 pages, bearing the above title and described as the "Official Story of the Civil Defence of Britain." Obtainable at the price of two shillings, from His Majesty's Stationery Office, London, it is a truly remarkable record of wonderful heroism displayed by the inhabitants of Great Britain and Northern Ireland, in the face of air raids of unprecedented intensity, actuated by fiendish malice and brutal ruthlessness. No one can read it without being moved by the tragically pathetic incidents which are narrated in plain, straightforward language, nor, at the same time, without feeling a sense of pride in belonging to a community which has manifested such resolute and unshaken resistance to the forces of evil and aggression.

Readers of this Journal will naturally be attracted to Chapter 11 which deals with "The Attack on the Ports," but though there might have been expected here some interesting detailed particulars of the extensive damage known to have been inflicted on port works—on docks and quayside equipment, on sheds and warehouses—there is a complete absence of any such details, lest, of course, the information should be of service to the enemy. This is a little disappointing, but in the circumstances inevitable, since the occasion is one which demands reticence, and it must be left to those who have actually witnessed the scenes of damage and ruin at the quayside to form an adequate idea of the widespread desolation which envelops many port and harbour installations in this country.

But there stands out in unmistakable prominence sufficient evidence to show the high courage and gallantry with which port officials and dock workers alike carried on their essential duties at a time when a natural and excusable inclination would have been to seek cover and safety. These brave men deserve the highest praise and it is unfortunate that scarcely a tithe of their heroic deeds can have come to light in the general turmoil and confusion of the attacks.

The German attacks on British seaports and dockyard towns, says the booklet, can hardly be fitted into a single strategical pattern. The ports took their turn with other vital centres as part of the targets in a general onslaught, which, by striking at civilian communities, was meant to slow down and cripple the British war machine.

Disregarding the plethora of descriptive matter available, observations in this review must be confined to features of port interest and limits of space will only permit of brief allusions to a few of the leading ports.

Fighting the Flames on Thames Side.

The Port of London

The first bombs on the London area fell on arable land at Addington in Surrey on 18th June, 1940. The Battle of Britain, however, did not begin on land till the early part of August, on the 12th of which month the enemy turned his attention to the Southern aerodromes and began sallies towards the metropolis which culminated at London on 7th September. On that day, Göring told the German people: "This is the historic hour when our air force for the first time delivered its stroke right into the enemy's heart." The attack came with 375 bombers and fighters in waves. They dropped bombs on Woolwich, at Beckton, on the docks at Millwall, on the docks at Limehouse and at Rotherhithe, on docks and wharves by the Tower Bridge and on the Surrey Docks generally. This preliminary day-time attack was followed up the same night by another flight of 250 bombers and, under the hail of their devilish cargoes, thousands of houses in the dockside boroughs were destroyed or damaged. Four hundred and thirty-five men, women and children lost their lives and 1,600 were seriously injured. This, however, was only "the beginning of sorrows." The capital was bombed every night in September by forces averaging roughly 200 planes. And the devastation by explosion and conflagration went on throughout October and less heavily in November. Something like 27,500 high explosive

Reviews: "Front Line, 1940-41"—continued

bombs were dropped during the three months—not all, of course, on dockland, though a large proportion fell on quays and warehouses. Other raids followed at irregular intervals—there was a particularly heavy one on the nights of 8th and 9th March, 1941, and two great April raids—but they cannot be particularised here.

The following brief quotation will serve as a picture of the strange things which happened in the dock area:

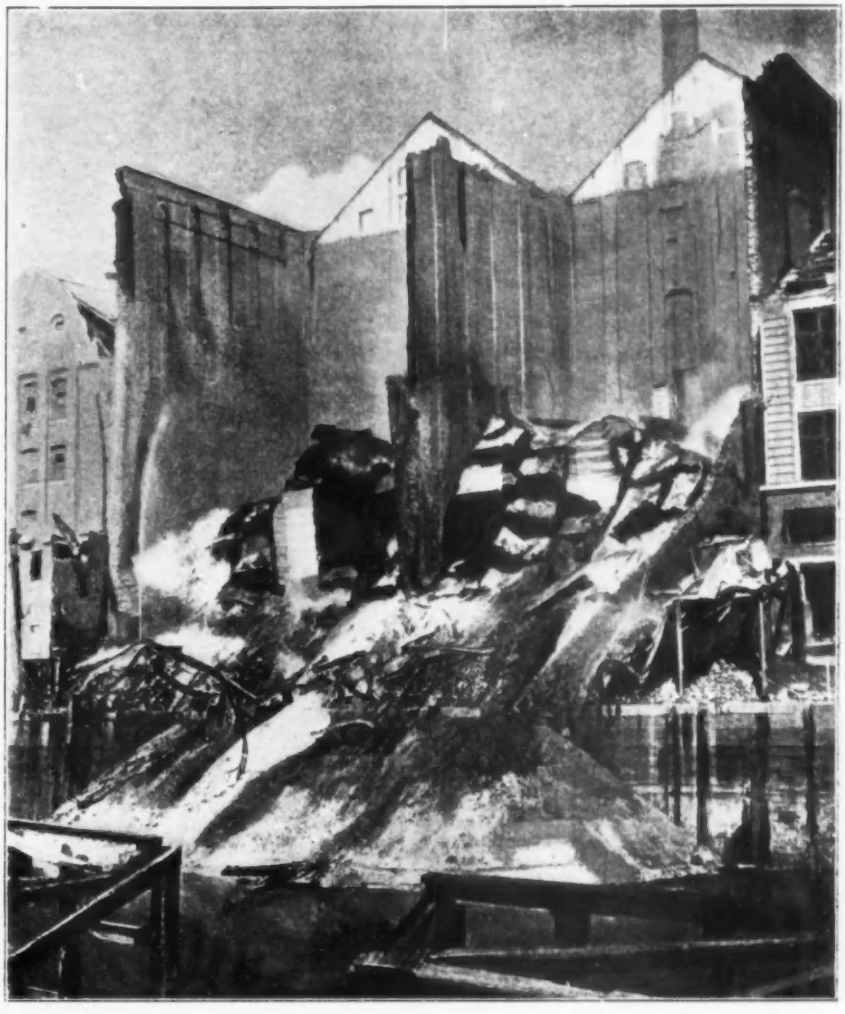
"There were pepper fires, loading the surrounding air heavily with stinging particles, so that when the firemen took a deep breath, it felt like breathing fire itself. There were rum fires, with torrents of blazing liquid pouring from the warehouse doors (nor any drop to drink) and barrels exploding like bombs themselves. There was a paint fire, another cascade of white-hot flame, coating the pumps with varnish that could not be cleaned for weeks. A rubber fire gave forth black clouds of smoke so asphyxiating that it could only be fought from a distance and was always threatening to choke the attackers. . . . A grain warehouse on fire brings forth unexpected offspring—banks of black flies that the firemen's jets wash off the walls, rats in hundreds, and as the residue of the burnt wheat, 'a sticky mess that pulls your boots off.'"

Merseyside

In the early part of the period, Liverpool was attacked 57 times and lost 520 citizens, before its first heavy night raid on the 28th November, 1940, when some 150 enemy planes attacked. There was another onslaught a few days before Christmas, with many hundreds of deaths, widespread fires and a good deal of damage. Then, in the middle of March, came two nights of brutal raiding, the casualties in which were as great as in the great Coventry raid, though the damage was less concentrated. With the shining water to help them, the German raiders were able to drop many of their missiles on the docks and dock buildings. Then came Merseyside's "May Week," when the policemen and firemen who guarded the docks during the first seven days of that month came "perhaps under as fierce an attack as any men in the whole course of the onslaught on Britain. High explosive and incendiaries fell in great weight upon the dock basins, the quays, the ships moored at their sides and the store sheds hard by. There was damage, but the marvel is that it had so light an effect and for so short a time, on the working of the port. . . At the end of this week of desperate risk and heavy labour the docks were working; handling a reduced volume of traffic for a time, but working. . . In all the Merseyside raids a total of 150,000 houses were damaged." Although it might have been feared that sections of the dockside population would show some weakness of nerve, there was no sign of anything of the kind. The police spoke in praise of the way in which the people stood up to their ordeal.

Elsewhere

The same story with variations of detail can be told about Southampton, about Glasgow and Clydeside, about Bristol, Plymouth, Portsmouth, Dover, Manchester, Hull, Swansea, Cardiff, Belfast and a score of other ports of varying importance. Southampton had 50 raids in which 2,200 bombs were dropped. At Portsmouth 65,000 out of a total of 70,000 houses were damaged or destroyed There is not space available to recount anything like adequately the ordeal through which British ports passed during those terrible days. Readers of this Journal, if they have not already done so, should procure a copy of the book and peruse for themselves the thrilling narrative which has been compiled for their edification. With the pictorial illustrations, it gives a vivid and graphic representation of scenes which will long remain imprinted in the minds and memories of those whose responsibility it was to administer and discharge the functions of British ports through those dire and perilous days.



Cascades of Smouldering Grain at the Port of Hull.

Greenock Port Finance.

A Provisional Order is being promoted for the purpose of obtaining authority for the Trustees of the Port and Harbour of Greenock to create a fund for the execution of certain works of replacement, renewal, and improvement, the present borrowing powers of the Trustees having been exhausted. The balance of rates and revenues of the port and harbours in each year is payable to the holders of the "B" Deferred Debenture stock by way of interest, and it has been agreed by the Trustees, as representing the various interests entitled to elect Trustees, that part of that balance should be available to form such a fund. The Trustees are also seeking power under the Order to vary the rates and charges on vessels and to make a charge of not exceeding one shilling in respect of each passenger who uses the port and harbours on any occasion of landing from or embarking on any vessel which does not enter the port and harbours, provided that the maximum charge to be made in respect of any person landing from or embarking on any such vessel on more than one occasion in any day shall be two shillings.

Notes of the Month

Death of Dock Engineer.

At the age of 74, the death has taken place of Mr. John Fraser Black, engineer to the Seaham Dock Company since 1916.

Aberdeen Harbour Board.

Bailie Mackie and Mr. M. H. Williamson have been appointed to the Aberdeen Harbour Board's Special Committee on post-war planning.

Lerwick Harbour Board.

Mr. William A. A. Tulloch has been appointed chairman and Mr. John W. Robertson, vice-chairman of Lerwick Harbour Trustees.

Clyde Lighthouse Trust.

The Clyde Lighthouse Trustees at their meeting on December 3rd re-elected Mr. John C. Graham as chairman, and Mr. Archibald N. Lindsay as vice-chairman.

Port Medical Appointment.

With the permission of the Corporation of the City of London, Dr. H. T. Morgan, Medical Officer of Health for the Port, has consented to act as consultant to the Ministry of War Transport on matters affecting seamen's health.

Spanish Harbour Projects.

The official German news agency reports from Madrid that important extension works are planned for the harbours at Gijón, especially the roadstead of the Musel harbour. The preliminary estimate of the cost amounts to 15 million pesetas.

Adriatic Port for Bulgaria.

It has been announced by German controlled wireless that an agreement signed between Italy and Bulgaria granted Bulgaria the use of the Adriatic port of Antivari, near the Yugoslav-Albanian frontier, as a free harbour. Antivari is to be connected with the Danube port of Rustchuk by a system of canals and waterways.

Record Activity at North American Lake Port.

In 1941, the Port of Hamilton (Lake Ontario) set an all-time record with 3,457,430 tons. The tonnage for 1942 has proved substantially greater, though the actual figures are not yet published. Bulk tonnage to the large industries is mainly responsible for the increased volume, coal and ore arriving in very large quantities.

New Heavy Lift Crane at Calcutta Docks.

One of the large " creeper " cranes, used in the construction of new Howrah Bridge at Calcutta has been acquired by the Commissioners of the Port for installation, after conversion into a travelling portal crane, at the end of the tongue between the two branches of the King George's Dock. The crane has a lifting capacity of 23 tons at 90-ft. radius, 33 tons at 60-ft. radius and 66 tons at 44-ft. radius.

Icebreakers on British Canals.

A staff of six engineers and six traffic controllers has been appointed by the Minister of War Transport to operate in six canal areas, keeping canals open to traffic during periods of low temperature and directing vessels so that the best use is made of available facilities. Two types of ice-breaker will be used. One with sharp rising bows will " fall " on the ice and crush a lane through it; another with a kind of " plank platform " on each side, can be rocked from side to side by men with ropes to break ice over a wide area. Some 2,500 miles of canal came under Government control last summer when they were put under six regional committees. About half the total tonnage carried on the canals is coal and coke. During the few years before the war canal traffic averaged about 13,000,000 tons a year.

Leith Dock Commission.

Mr. Hugh Rose has been re-elected chairman of the Leith Dock Commission and Mr. W. M. Smellie, convener of the finance committee. As convener of the works committee, Mr. A. F. Henry takes the place of Mr. W. A. Whitelaw, who has resigned.

New South African Dry Dock.

The new dry dock for the Port of East London promised by Mr. F. C. Sturrock, Minister of Railways and Harbours, is to have a length of approximately 680-ft and will be able to take the largest type of British cruiser, apart from merchant vessels up to 6,000 or 8,000 tons. The estimate of cost is over £500,000.

Dunbar Harbour.

A specification has been received by the Town Council of Dunbar in reference to the restoration of the Victoria Harbour in the port. It has been decided by the Harbour Commissioners to deal with first aid repair, amounting to £425, leaving a much greater outlay to be faced later.

Mayoral Visit to Cardiff Docks.

An official " courtesy " visit has been paid by the Lord Mayor of Cardiff, Captain Jas. Griffiths, accompanied by the Deputy Lord Mayor and the Town Clerk, to the commercial community at the Cardiff Docks. He was received by Mr. H. C. Bolter, President of the Cardiff Chamber of Commerce.

Swedish Port Appointment.

The Stockholm Harbour Board have appointed Mr. Erik G. V. Nystrom of the Gefle Corporation as manager, in succession to the late Mr. Salomon Vinsberg. The appointment is for a period of six years as from December 1st last. Mr. Nystrom had previously served with the Stockholm Harbour Board as secretary, jointly with the Industrial Works Association.

Clyde Navigation Trust.

At a recent meeting of the Clyde Navigation Trust, Mr. William Cuthbert was re-elected chairman and Mr. Jas. Leggat, vice-chairman. A protest was made by Sir Patrick Dollan, ex-Lord Provost of Glasgow against what he considered an intervention in the affairs of the Trust by the Regional Commissioner for Scotland in connection with the visit of Mrs. Roosevelt to the Clyde. The matter was referred to the General Purposes Committee for consideration.

Tees Conservancy Commission.

Mr. P. Walker, district goods and dock manager for L.N.E.R. in Middlesbrough, has been appointed as representative of the Ministry of War Transport on the Tees Conservancy Commission in succession to Sir Francis Samuelson, who recently retired from the Board of which he was chairman. Mr. Walker has spent 33 years in the railway service. He is chairman of Middlesbrough Port Emergency Committee of the Port Labour Employers' Association and also of the Local Joint Council and Dock Registration Committee.

Completion of Leith Docks Improvements.

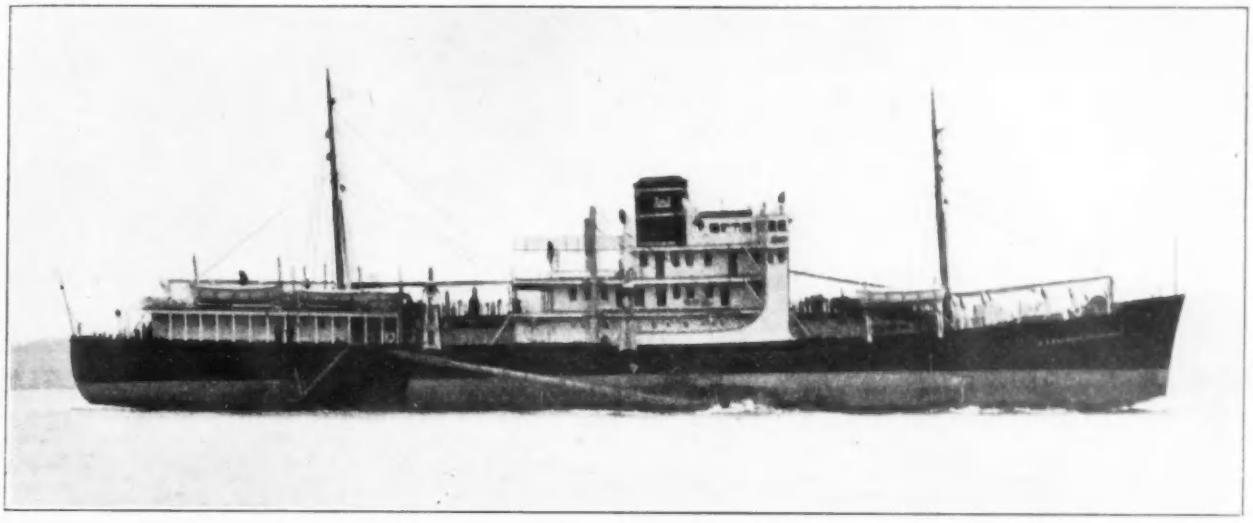
To mark the completion of improvements at Leith Docks, Mr. Thomas Johnston, the Secretary of State of Scotland recently unveiled a stone memorial plaque. Mr. Hugh Rose, chairman of the Leith Dock Commissioners, who presided at the ceremony, which, he explained, was private, said that the improvements, now finished, were merely " the end of the beginning " of a scheme which would make it possible for Leith to take its place in the post-war development of industry and shipping. Among those present were Lord Rosebery, the Regional Commissioner; Sir Gilbert Archer, District Commissioner; Mr. J. Dalgleish Easton, clerk and superintendent, Leith Docks, who was engineer of the scheme and Mr. B. J. Allison, chairman of the firm of contractors.

*Sea-going Hydraulic Hopper Dredgers**

History of their Design, Development and Operation

By Lieut.-Col. H. B. VAUGHAN, Jr., Corps of Engineers, U.S. Army.

(Continued from page 187)



Dredger "Chester Harding." Sea-going hopper dredger, displacement, 4,000 tons; length, 308-ft. 2-in. overall, between perpendiculars, 300-ft.; beam, 56-ft. moulded; depth, 29-ft., moulded; draft forward, 17-ft.; draft aft, 20-ft. Steel construction. Hopper cap. 2,700 cu. yds.

Method of Operations

After the construction kinks have been ironed out of a seagoing hopper dredger, its crew secured and made familiar with its newer features, and the hundred and one diversified services made to do their bit to the satisfaction of the builder and the Government, the life of the dredger as a mud digger really begins.

If possible, its shake-down trials and tests are made at a site where the dredger will actually work so that the benefit of more than a stage setting is had and dumping grounds, turning basins, critical points of traffic, character of materials to be handled, cross-currents and tides can be taken into account and studied at the same time.

Assuming that the dredger has passed her final examinations, has her diploma duly displayed in her pilot house and has secured a job after commencement, she proceeds from her berth and loses as little time as possible arriving at her working ground, say an approach channel to a harbour. A survey has already been made, ranges provided and a disposal area, for the mud she is to dig, agreed upon. Those in direct charge have studied the particular job and have had similar experience elsewhere.

Upon arrival at the working point the drags are ordered to be lowered by signal from the bridge, the officer in charge of the particular watch instructs the quartermaster as to speed and course to be maintained, the dredging pumps are started, the hoppers are pumped full of water, the overflows are adjusted and gradually the drags settle into the material to be pumped from the bottom of the channel into the hoppers.

That does not sound either complicated or difficult, yet, like all things of magnitude, most of the fine co-ordination of man and machine is not immediately obvious to the uninitiated.

The dredger proceeds over its prescribed course, interfering as little as possible with the passing vessels whose passage it is making possible. Its speed and course are adjusted to the wind, tide and cross-currents and after a time it is determined that a pay load has been secured.

The drags are ordered to be raised, and the dredger betakes itself as expeditiously as possible to the dumping grounds, using all the power available—possibly a part of the power that operated the dredging pumps supplements that of the propelling power, now that pumping operations are temporarily interrupted. Here is where the skill of the seaman contributes his part, for time saved is money saved.

Upon arrival at the disposal area, the mechanically-operated hoppers are opened in the order best suited to the conditions of sea and wind and the hull rises to its light draft marks as the dredger straightens out her course for a return to the digging ground to repeat the operation over and over again—each time placing approximately 5,000 to 5,600 cubic yds. of obstructing material outside of the limits of the channel being improved. That's a lot of mud, if compared with other methods of moving spoil. One thousand 5-yard dump trucks would make a sizeable parade of approximately ten miles and probably would be ten times as long in receiving and getting rid of their loads if they travelled the same distance as the modern dredger does for the same purpose.

Economic Loading

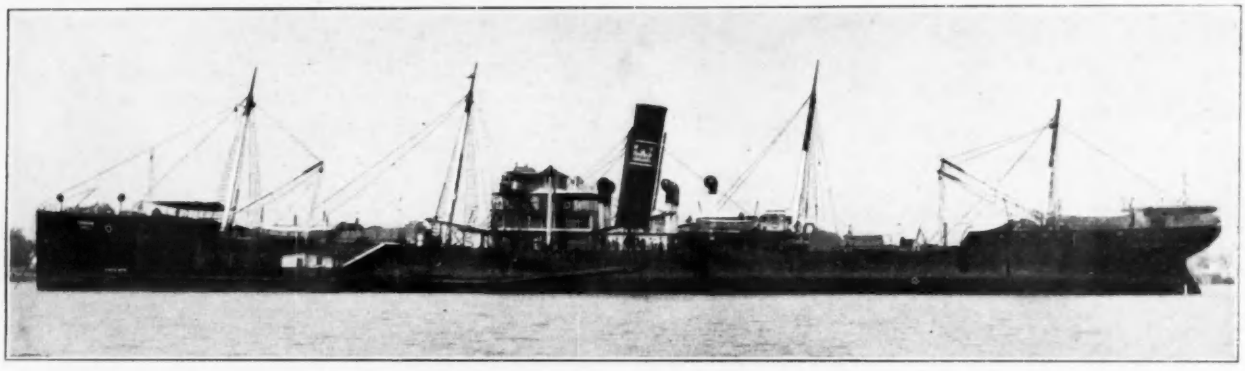
As has been said previously, time is the essence of present-day dredger operation. How long does it take to secure a proper load? How long must the pump pour a mixture of water and solids into the hoppers of the dredger before it is time to lift the drags and head for deeper water to dump this burden?

Strange to relate, in the earlier stages of dredging technique very little thought was given to this all-important item of the cycle of hopper dredger operation.

The mate on watch or some hopper gate operator frequently signalled the bridge and indicated that "she's loaded." It is obvious that the class of material determines to a great extent the time of precipitation of solids in a water mixture. The amount of disturbance or ebullition in the hoppers themselves, the speed

*Reproduction of Paper read before the Society of Naval Architects and Marine Engineers, New York, U.S.A., in November, 1941.

Sea-going Hydraulic Hopper Dredgers—continued



Suction dredger "Chinook." Length, overall, 360-ft.; beam, moulded, 49-ft.; depth, moulded, 34-ft.; draft, light, forward, 17-ft. 5-in., aft, 19-ft. 5-in.; draft, loaded, forward, 26-ft. 5-in., aft, 38-ft.; displacement (2,240 lb. tons), light, 7400, loaded 12,500.

of discharge, the size and position of the overflow from the hoppers—all are factors in the very important question.

Only in theory is all the solid material pumped aboard retained and none lost in the overflow. To gain gradually a load of comparatively solid material, much mixture must be carried aboard and some slowly settling materials must necessarily be lost over the sides. Very heavy, clean sand stands at the top of the list of desirable materials for quick loading, and light, slowly precipitating silt is close to the bottom. Sometimes to get the most solids in the least time it is necessary to integrate. You want a full load, if you can get it, but you can't take all day to get it.

You can easily conceive of a silt so completely in suspension as to require days to settle out and which, with the disturbance in the hoppers and the necessary speed of discharge, would never become a solidified load. Of course, such a silt is hardly a proper material for a hopper dredger unless used purely as an agitator—a proper use under special conditions.

"Gen. C. B. Comstock," wooden hull, sea-going dredger, U.S. Engineers, side drag type; 300 cubic yards. One of the first effective dredgers of its kind.

The determination of the economic loading time is approached somewhat as follows: At the commencing of the load a sample of the material is taken coming into the hoppers and a sample of the overflow is taken and allowed to settle. As the loading progresses, soundings are taken at regular intervals in the hoppers and a rate of fill determined. This rate may not be as constant when the fill in the hopper nears the top. If the solids in the incoming mixture are inclined to settle in a reasonable time, a longer time period of getting the pay load must be justified or vice versa. The judgment of the dredger master or the experience of the inspector who is calculating the load must play its part.

Uses—Special and Otherwise

In addition to the more prosaic everyday work of commerce, the seagoing hopper dredger has a part in numerous phases of emergency work. The digging and delivering of construction materials, such as sand, gravel and crushed stone, the dredging of berths and making accessible satisfactory fill are some everyday uses.

At times dredgers have served as emergency towboats to disabled vessels in distress, and they have assisted in rescue work. They are potential carriers of men and munitions, and coal and bulk supplies. They have been used to handle large quantities of water.

At times the fine communications system aboard the modern seagoing dredger has rendered a service of great importance because of its location at a special point in our sea lanes or at the entrance to our vital ports of entry. During periods of national emergency ample opportunity, no doubt, will occur to make further good use of such special equipment.

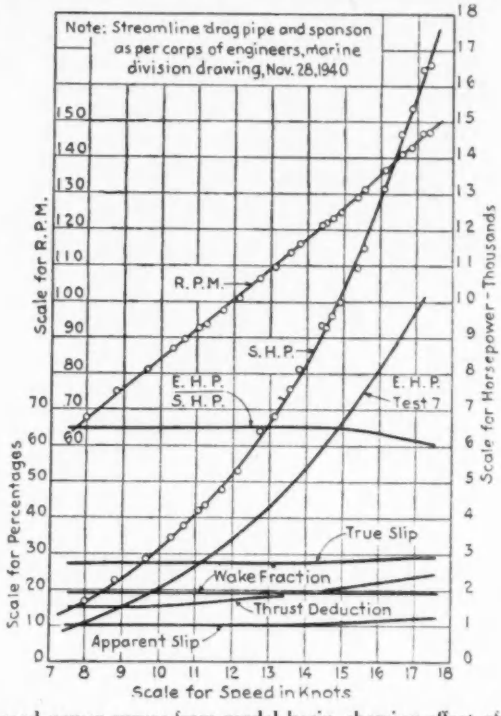
Part Played in National Defence

It is obvious that the seagoing hopper dredger is essential to the digging and maintaining of the harbours and sea channels, without which our United States Navy and Merchant Marine in their present state of development would be greatly handicapped in our plan of national defence.

Deep-water harbours on the Atlantic seaboard are few and far between. Boston, New York, Norfolk and Charleston have for some time had 40-ft. of water which will accommodate deep-draft vessels. New Orleans, ever becoming more important strategically in dealing with United States defence and relations with Latin American neighbours, has a new 40-ft. project approved, but as yet undug; and Philadelphia, because of her commanding industrial position and her large shipbuilding and repairing facilities, is fast becoming a 40-ft. harbour through the efforts of the greatest armada of dredgers of the hydraulic seagoing hopper type that has ever been concentrated in one locality. From the standpoint of national defence, this work must be completed in one-quarter of the time ordinarily consumed in such an undertaking, and 11 of the Government's fleet of 25 seagoing hopper dredgers have been busily engaged in the Delaware.

Sea-going Hydraulic Hopper Dredgers—continued

Not only must existing channels be maintained to desired depths and others deepened, but our defence plans include new harbours and protection for ships and shipping—and hydroplanes as well.



Speed power curves from model basin, showing effect of streamlining drag pipe and sponsons on power required.

Most of our newly-acquired air and marine bases from Newfoundland to British Guiana will require dredging. While the seagoing hopper dredger is not necessarily the only type of dredging machine called into action on this war work, it is the only one that can work in rough seas and get there and come back without fail in the least time.

The outmoded hopper dredgers no longer capable of first-line defence work have in their old age contributed a final service to the defence programme, too—the small Fruehling-type hopper dredger *Minquas* and the steam hopper dredger *Comstock* have both been stripped of their dredging equipment and converted into passenger and freight carriers to be used in the outlying defence work in the Carribean—not an inglorious last contribution to the national emergency for which their modern sisters are more effectively carrying the brunt.

Without the seagoing hopper dredger to prepare and maintain deepsea outlets, the part of our national defence plan played by dredgers of other types would avail nothing—and the waterborne commerce of our inland waterways, our rivers and our intracoastal canals would be greatly embarrassed. The United States would soon become isolated to a point that the isolationists never even dream of if our seagoing dredgers were destroyed or did not keep pace—even for a year.

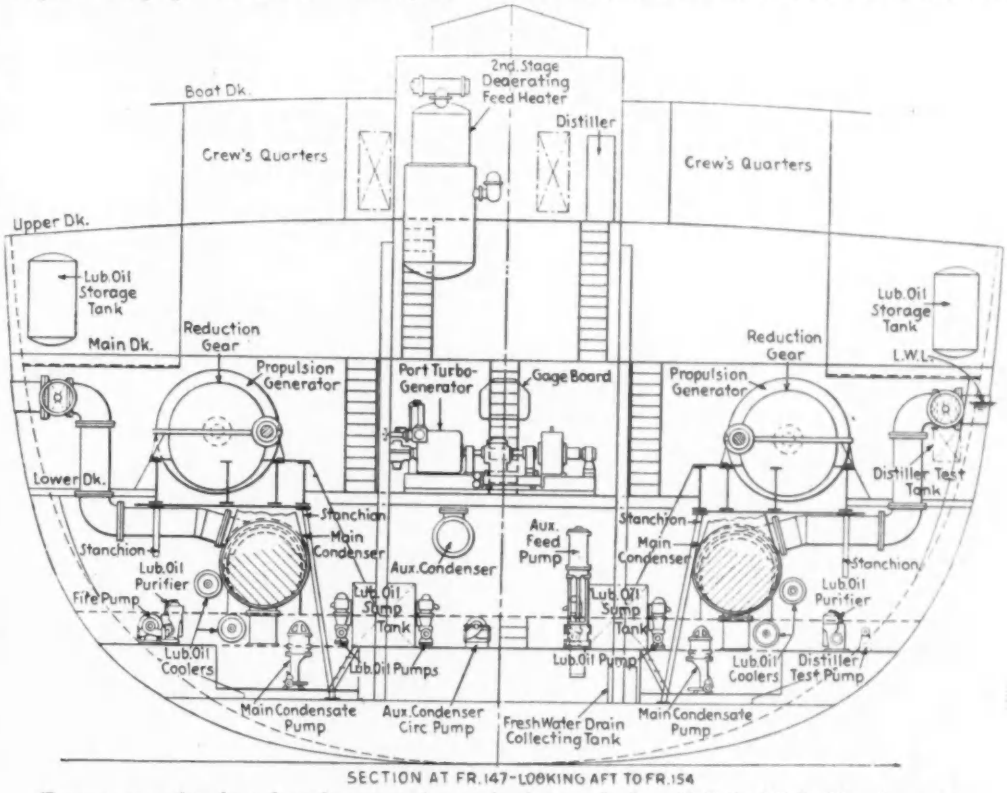
The fine United States Navy has always been conceded to be the country's first line of defence. The seagoing hopper dredgers of the Corps of Engineers of the army are an important auxiliary to the first line of our national defence.

A definite plan of replacement of at least fifteen outmoded seagoing hopper dredgers has been prepared by the Engineer Department. In view of the present national emergency requiring the facilities of all available shipyards for other purposes, the fulfillment of this plan will, of necessity, depend upon this factor. This plan includes the construction of a modern seagoing hopper dredger, now termed Hull No. 226, which will be described in detail in the following sections of the paper.

Design of "Hull No. 226"

Hull No. 226 is designed to operate primarily in the maintenance of channels of the Ports of New York and Norfolk. The maximum distance from the dredging area to disposal grounds in the two ports is 35 miles. The average haul is 20 miles for the removal of 10,000,000 cubic yds. annually, of which amount the dredger *Goethals* removed 50 per cent. in 1940. Hull No. 226 will be a faster and larger dredger and with the *Goethals* will adequately take care of dredging at New York and Norfolk, thus releasing smaller dredgers for important work elsewhere.

The *Goethals*, with a maximum hopper capacity of 5,000 cubic yds. and a speed of 12.4 miles per hour loaded, and of 15.4 miles per hour light, when dredging mud, required 6 hours and 24 minutes to make a trip of 40 miles from cut to dump and return, including turning and dumping. When dredging sand, the round trip required 4 hours and 50 minutes. The average load of mud was 4,700 cubic yds., and the maximum load of sand was 5,000 cubic yds. From the recorded dredging data of the operation and costs of the more efficient dredgers, graph curves were prepared. From these graphs, it has been determined that the most economical speed is an average speed, between loaded and light condition to the dump and return, of 15 miles per hour (13 knots) for a 20-mile haul; for a 25-mile haul the economical speed

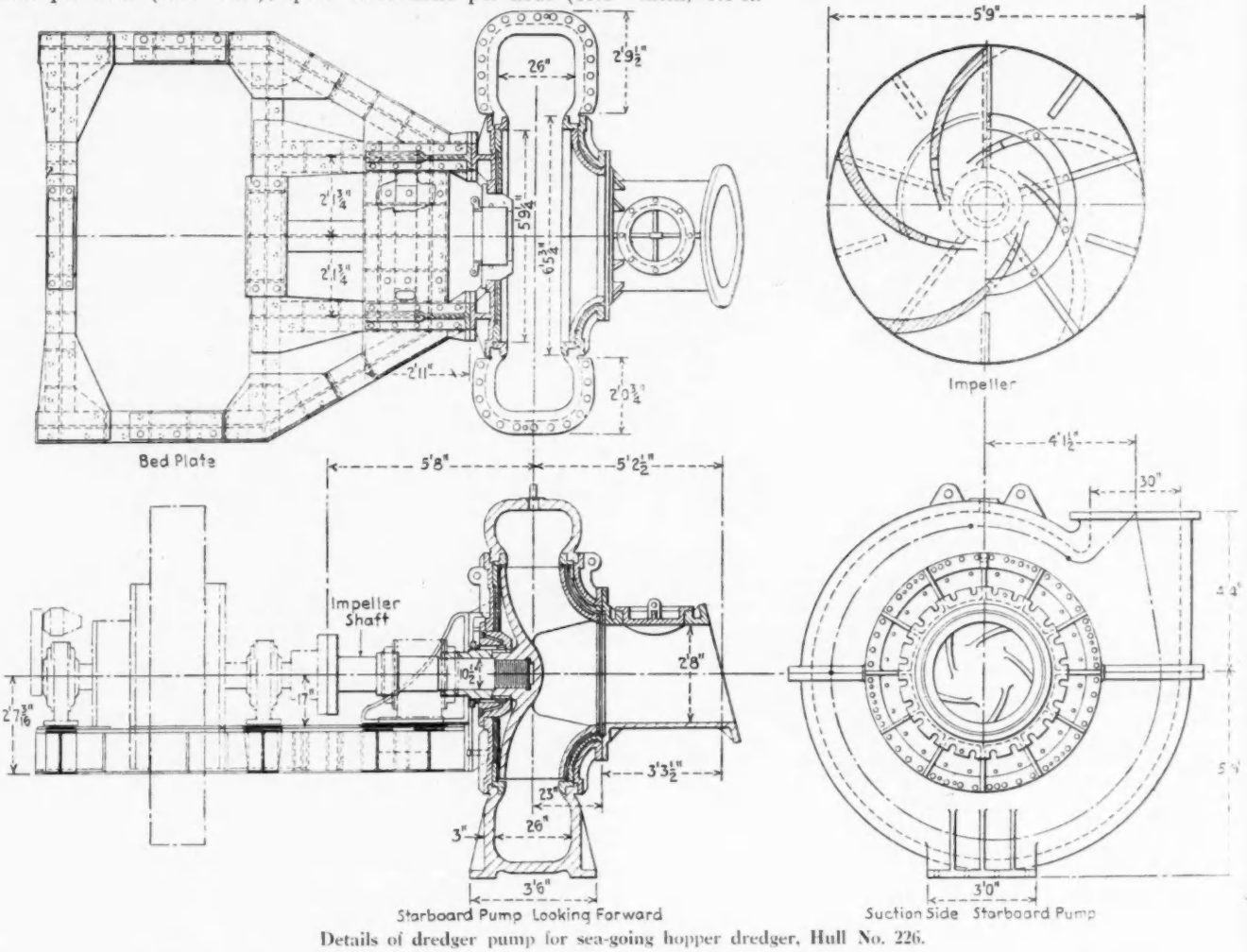


Transverse section through engine room of sea-going hopper dredger, Hull No. 226, looking forward.

Sea-going Hydraulic Hopper Dredgers—continued

was the same. The lesser average speed of 12 miles per hour cost appreciably more for both lengths of haul. For the greater average speed of 16 miles, the cost rises both in the 20-mile and 25-mile hauls. As a further check on ascertaining the economical size of the dredger, other graphs were prepared, the results of which confirmed the size as a 5,000 to 5,600 cubic yd. dredger for the 20-mile and 25-mile hauls at the speed previously determined. The decision made, therefore, was to adopt the design of a 5,600 cubic yds dredger with a loaded speed of 15.5 miles per hour (13.4 knots); speed of 18 miles per hour (15.5 knots) with water only in its hoppers; and having a light speed of 19 miles per hour (16.5 knots).

Since turbulence in the bins, when dredging mud, is due to the high velocity of material and water being pumped in the bins, a 30-in. vertical movable topping board which increases the height of the bins will be added, thus minimizing the velocity and reducing the loading time.



Details of dredger pump for sea-going hopper dredger, Hull No. 226.

Dimensions

The trim lines and refined appearance of Hull No. 226 do not bespeak a mere matter-of-fact mud digger. Since this type of vessel has many of the characteristics of a normal seagoing ship, and is, in fact, called upon to go to sea both to discharge loads and to move from port to port as dredging operations require, the form of the vessel is held reasonably close to that of a commercial ship of similar size and speed.

The principal dimensions are:—

Length overall, 491-ft. 3-in.; length between perpendiculars, 480-ft.; beam, moulded, 72-ft.; depth, moulded, to upper deck at side, 36-ft. 3-in.; designed load draft, moulded, 25-ft. 6-in.; designed load draft, bottom of keel, 25-ft. 7⅜-in.; capacity of hoppers, at 25-ft. 6-in. draft, 5,600 cubic yds.; and density of material at 5,600 cubic yds., 125 lbs. per cubic ft.

Hull form characteristics at 25-ft. 6-in. moulded draft are:—

Block co-efficient, moulded form, 0.657; prismatic co-efficient, moulded form, 0.682; mid-section co-efficient, 0.963; waterplane co-efficient, 0.782; tons per inch, 64.4; moment to trim one inch, 1,785-ft.-tons; and L.C.B. forward of amidships, total displacement, 0.6-ft.

The speed-length ratio at 13.4 knots on 840-ft. is 0.612. Comparison of prismatic or block co-efficients appropriate to speed-length ratios indicated that the displacement and co-efficients of form were suitable for a speed of 13.4 knots, loaded, with a shaft horse-power of 7,000 at 112 revolutions per minute. The cruising radius, with the dredger light (that is, with a displacement of 8,200 long tons), at 16.5 knots is about 5,855 nautical miles.

The speed-length of 0.612 indicated that both waterline and sectional area curve forward should be hollow. Accordingly, the forward sectional area curve is given a distinct hollow and rather full shoulder; and the load water-line, a long easy hollow and very moderate entrance angle.

The body sections of the bow show little departure from those found on a normal seagoing vessel of conservative design. It was not thought necessary to use a bulbous form of bow. The sections show a moderate flare, starting well below the waterline and avoiding any abrupt change of shape, together with a rounded, moderately-sharp forefoot—all tending to provide an easy-riding, dry ship in rough water. The forefoot is given a

Sea-going Hydraulic Hopper Dredgers—continued

moderate cutaway to improve steering qualities. The stern is of the cruiser type.

The generous breadth of 72-ft., giving a length to breadth ratio of 6.67, was adopted for two reasons. First, considerable stability is required in a vessel of this type. Second, this breadth enabled ample displacement to be obtained without having the block and prismatic co-efficients exceed a very conservative limit for the speed required, while avoiding additional length.

The material dredged does not always weigh 125 lbs. per cubic ft., so estimates were made with material weighing as little as 110 lbs. per cubic ft., with a result that the cubic capacity can be increased to 6,300 cubic yds. when dredging light material. To provide this additional hopper capacity, sliding steel overflow boards, 30-in. high, raised and lowered by mechanical means, are arranged along the top of the inboard side of the overflow troughs.

(To be continued)

Review

British Ports and Harbours, by Leo. Walmsley. Pp. 48, with 9 coloured plates and 23 illustrations in black and white. Price 4s. 6d.; 1942, London: Wm. Collins.

This artistic and entertaining little brochure, written in a chatty, conversational style, provides a compact *vade mecum* to the chain of ports lying round the coastline of Great Britain and Northern Ireland. It is certainly not intended as a analytical or statistical essay from which the student could gain exact and precise details of the shipping and commercial activities of British ports; on the contrary, it is a gossipy guide book, which, besides its descriptive matter, abounds in incidents of human interest, as when, at the outset, the author relates an escapade of his boyhood days, in which he made a truant tour of the Liverpool docks.

The mere enumeration of the ports included in the author's itinerary would fail to convey an adequate idea of the contents of the volume. The ports receive notice in varying degree, those described at greatest length being Liverpool and London. The latter is referred to as "probably the greatest seaport in the world." The superlative is advisedly qualified, and we cannot but make the comment that New York, not to say certain ports in the Far East (before the war), would "probably" have something to say about it. Much depends on the standard of measurement, for it is, indeed, an extremely difficult matter to devise a reliable and acceptable standard by which the relative importance of ports can be gauged.

Perusal of the book will undoubtedly afford pleasure in a leisure hour and the coloured plates possess much antiquarian interest, as well as pictorial charm. By the way, the initials of the artist, Whistler, were J. A. (Abbott) M., not J. W. M. as printed, and "Worthington (p. 42) is surely a misprint for Workington. But these are trifling blemishes in an engaging publication upon which the author and publishers alike are to be complimented.

Proposed Floating Dock for Prince Edward Island.

A proposal is on foot to construct a floating dock of 3,000 tons capacity at Southport on Prince Edward Island.

Port Congestion in South Africa.

With the object of relieving the heavy congestion of import cargoes which has prevailed for some time at ports in South Africa, the Commissioner of Customs of the Union, through the High Commissioner's Office in London, has been urging British suppliers to forward advance copies of invoices. It is pointed out that arrangements already exist between many of the larger importers and their suppliers to forward, as soon as the goods are packed and ready for shipment, advance copies of invoices and that these advance copies have been found to be of great assistance in the identification of packages, thus facilitating and simplifying the clearance of goods through the Customs. The general adoption of this practice is urged upon all suppliers in the United Kingdom.

Notable Port Personalities

XXX—Mr. Robert Letch

Mr. Robert Letch, recently appointed Regional Port Director for the North Western area of England (covering all ports from Holyhead to Silloth), in succession to Mr. J. Gibson Jarvie, who resigned in October, was born on 10th January, 1899.

Mr. ROBERT LETCH.

He entered the service of the Port of London Authority as a junior officer in May, 1915, and was trained in dock operations at various docks of the Port of London. Subsequently, he held successive positions in the service, rising to that of Assistant Dock and Traffic Manager, a post which he held from 1935 to 1938, when he was appointed Assistant General Manager and served in an advisory capacity on port questions for the Food Defence (Plans) Department of the Board of Trade and later the Ministry of Food.

Meanwhile, he had studied port conditions successively in Australia, New Zealand, the United States of America, Canada and South Africa, and had visited all the principal European countries.

In September, 1940, Mr. Letch was seconded to the Ministry of Transport and in January, 1941, was appointed Regional Port Director for the Clyde area. In July, 1941, the jurisdiction was extended to cover all Scottish ports.

During the earlier European War, Mr. Letch served from 1917 to 1919 with the R.F.C. and the R.A.F.

A Handbook of Empire Timbers.

The Department of Scientific and Industrial Research has been informed by H.M. Stationery Office that copies of the 1939 edition of their *Handbook of Empire Timbers* have now become available and may be obtained from their Sales Offices at 3s. 6d. (or 3s. 9d. post free) per copy. The handbook contains general descriptions of a large number of Empire timbers, their strength, seasoning and other properties, working qualities and uses. Additional information on some of the timbers dealt with and on sixteen species not described in this edition will shortly be published by H.M. Stationery Office, in a War Emergency Supplement.

*Recent Developments in Refrigeration**

By LORD DUDLEY GORDON, D.S.O., M.I.Mech.E.
(Member of Council).

Comparisons between Old and New Plants at British Ports

Some interesting comparisons can be made between refrigerating plants installed a good many years ago and those which have taken place in recent years. Two British port examples are given below.

Dockside Cold Store

Fig. 1 shows the original engine room of a large dockside cold store at a port on the South Coast of England. It contained four vertical ammonia compressors drivne by horizontal steam engines. Fig. 2 shows the same engine room photographed from the same position 35 years later. The four large compressors have been replaced by three high-speed modern vertical compressors occupying only a small fraction of the space of their predecessors, but performing the same duty. In this particular view the compressors themselves are almost completely concealed by the insulated suction pipes which are carried up from the floor beneath.

Ice-Making Plant at Fishing Port

The improved circuits which are described in the Paper, and the form which condensers, and evaporators now take are not only commonly used in the construction of new refrigerating installations, but the same principles can be applied to improve the performance of old installations. It may be of interest to give an example of how this has been achieved in a specific case.

Fig. 1. International Cold Stores: Original Engine Room.

The case is that of a large ice-making plant in a fishing port on the East Coast of England. The factory was originally built in 1900, and by means of additions provided in subsequent years the output had by 1929 reached 720 tons of ice per day. The plant consisted of four large horizontal ammonia compressors driven by vertical triple-expansion steam engines; there were also two horizontal double-acting compressors, installed at a later date and driven by vertical compound steam engines; the layout also included six Lancashire boilers which had been fitted with superheaters some time after their original installation. The condensers were of the atmospheric type situated on the roof, and in all the tanks ice was made in cans.

In 1930, an account of the necessity for providing increased output, it was decided to replace the steam-driven plant with vertical high-speed ammonia compressors direct-coupled to electric motors. Four such machines were provided and were placed in the engine room formerly occupied by the two horizontal steam-driven machines. Fig. 3 illustrates the layout of the factory after the alterations were completed, with the space occupied by the old steam set shown dotted on the plan of the engine room containing the electrically driven compressors. The ice tanks themselves were not altered, but new evaporator coils were fitted and were provided with arrangements for the recirculation of the ammonia liquid by means of separator vessels and pumps. As the tanks were at different levels, a separate separator vessel and pump had to be suppplied for each tank. These separator vessels were provided with regulators of the low pressure type actuated by means of a float controlling the level of the

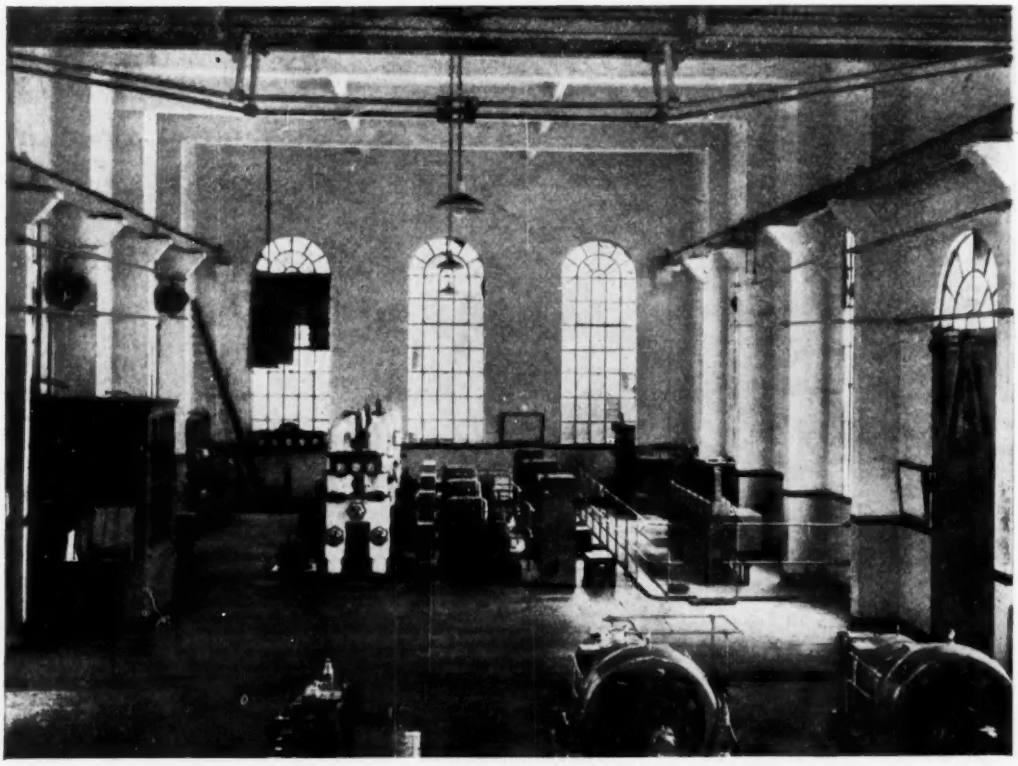


Fig. 2. International Cold Stores: Modern Engine Room.

*Extracts from 29th Thomas Hawkesley Lecture to the Institution of Mechanical Engineers, November, 1942. The Paper covers a wide range of topics: historical and technical. The extracts are limited to port works.

Recent Developments in Refrigeration—continued

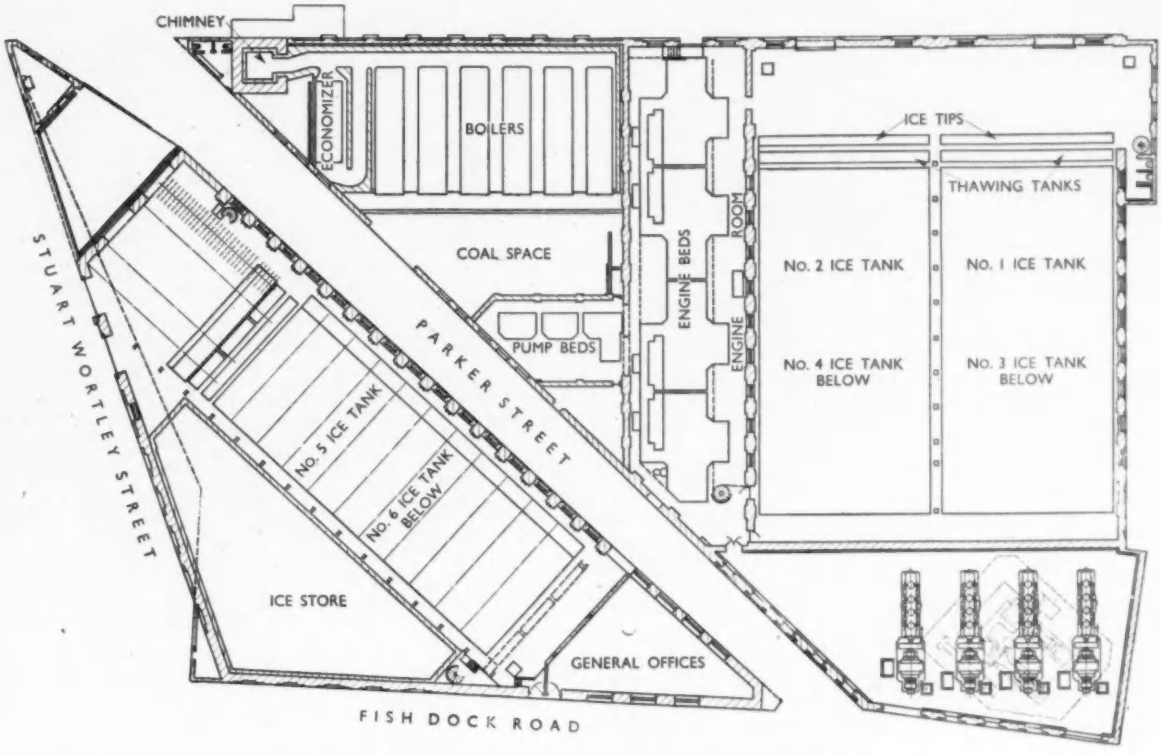


Fig. 3. Layouts of Old and New Ice-making Plant at Fishing Port.

ammonia liquid in the separators. The arrangement is indicated in Fig. 4, from which it will be seen that the gas leaving the compressor passes first through a heat exchanger, in the tubes of which water is circulated and heated; the water is then passed to the thawing tanks, where the heat thus applied thaws the ice from the sides of the cans so that it can be tipped out. Some provision of this sort had to be made to take the place of the steam heating originally used. The arrangement provided removes the first superheat from the ammonia gas and facilitates the separation of the oil from that gas as it passes through the oil separator on its way to the condenser.

The thawing-off of ice in an ice factory is not a continuous process. Means had therefore to be provided to supply the heat exchanger with cooled water when no thawing is in progress. This was achieved, as shown on the diagram, by the provision of a set of cooler coils standing along side the ammonia condenser coils and cooled by the same water. Water passing through the heat exchanger is circulated inside these coils when thawing of the ice is not in progress, and is cooled by dock water passing over them. It is interesting to record that all these alterations were carried out without interruption to the output of the factory.

The results achieved may be summarized as follows: The output of the factory was increased from 720 tons per day to 1,100 tons per day. An area of 4,800 sq. ft. occupied by the boiler house and coal handling space, and another of 3,600 sq. ft. occupied by the engine room containing the four original compressors and engines were set free for other purposes. The four machines giving the output of 1,100 tons per day are accommodated in the same engine room which formerly contained the compressors and engines producing 200 tons per day. Reduced to square feet occupied per ton of ice manufactured, we get: for the old plant 15.5 sq. ft. per ton; and for the new plant 2.5 sq. ft. per ton. The average electric current consumption per ton of ice made for the first twelve months after the alterations were completed was 35 units, compared with a consumption before the alterations were made of just under 1 cwt. of coal per ton of ice made.

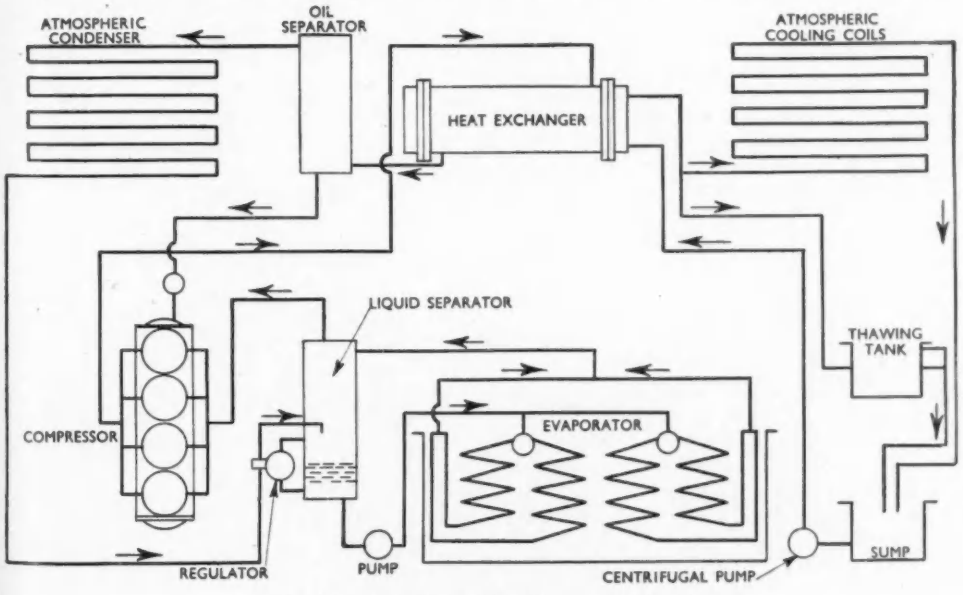


Fig. 4. Circuit for Ice-making Plant at Fishing Port.

National Dock Labour Corporation

Chairman's Address

Financial Deficit

At the second annual meeting of the National Dock Labour Corporation, Ltd., held in London on December 16th, Mr. R. T. Garrett (chairman), presiding, said in the course of his address, that the accounts covered a period of only eight months and in that period there had been an excess of expenditure over income of £149,100. One of the reasons for the heavy debit balance was that it had been necessary to make provision for holiday pay in respect of the calendar year ending December 31st, 1942, whereas revenue from the ports were restricted to periods varying from one to six months only. The main reason for the unhealthy condition of the Corporation's finances was that the ports under its control included all the ports where employment was bad and comparatively few where employment was good.

Attendance Money

That was reflected in the amount of £340,823 shown in the income expenditure account as attendance money paid to men in the Reserve Pool. That amount, spread over all the registered men, excluding weekly workers, was equivalent to a weekly outlay of about 19s. per man, and represented the cost to the Corporation of maintaining a national reserve of the labour for the industry. It was a continuing burden to the Corporation, although since the date of the accounts the cost had shown a tendency to decrease.

While they had to bear the whole cost of maintaining a national labour reserve, they received no contribution to that charge from the ports under Ministry of War Transport Schemes where employment generally was plentiful and regular; moreover, in seven months the Corporation had supplied over 7,000 men to those ports and there had been as many as 1,600 men on transfer at one time. Under those circumstances even the very heavy premium which they charged on wages in the ports had been insufficient to meet costs, and no appreciable improvement was to be anticipated until a more equitable distribution of the burden could be attained. A scheme such as that of the National Dock Labour Corporation was essentially national in its range, and if it was to become self-supporting, the financial basis should also be a national one.

Local Operational Schemes

Turning to the operational side of the undertaking, the chairman said that a year ago they had one scheme in operation at Bristol. To-day schemes were operating at 32 ports and they had on their books 32,315 port transport workers. That was more than 50 per cent. of the workers in the industry and there were now only about 1,000 men scattered throughout the numerous small ports who were not covered either by the Corporation's schemes or by the schemes of the Ministry of War Transport. There were only three ports of those originally scheduled by the Minister of Labour still waiting to be brought within the fold, and they had at the Minister's request brought in some ports not included in the original schedule. Since the introduction of a scheme in a port automatically brought all the workers of that port into regular employment, in the sense that they were employed each day either by a registered employer or by the Corporation, they could claim to have achieved the second objective set by the Minister of Labour, namely, that of continuous employment.

But that would be a narrow interpretation of their obligations, and they should not rest content with it. Their aim must be so to adjust the labour to the work that each worker on their books not only had regular employment in the sense they had now given it to him, but had also the greatest possible measure of regular work. That was what the port workers themselves wished—they wanted work rather than attendance money. He was not sure that they could not claim already to have contributed to a reduction of the labour surplus. In April last the average daily surplus in their ports was about 8,000. By October, in spite of the fact that in the interval 15 more ports had been brought under their control, the figure had fallen to the neighbourhood of 6,000. The figure fluctuated in accordance with the flow of work—a factor entirely outside their control—but they might claim that their activities had helped towards that reduction.

Labour Transfers

One of their most important functions had been the operation of the Transfer Scheme. This had features which were not to be found in any other industry. In most other industries, war-time dislocation had involved the transplanting of large bodies of workpeople for a prolonged period. The Corporation's transfer scheme presented a very different problem. It contemplated that the port transport worker should be prepared to be uprooted like any other worker, but, instead of being given the opportunity to settle down and acclimatise himself to his new surroundings, he was as a rule only left there for a few days or at most a week or two. It was perhaps not surprising that transferees were regarded as a prolific source of trouble in the ports, or at least the troubles which had occurred had more than once been ascribed to men transferred into the port from outside. Within the last eight months, April to November inclusive, the Corporation had effected long distance transfers of 17,026 men. That was against requisitions aggregating 17,451, so the Corporation had fulfilled 99 per cent. of the requisitions. Additionally they had transferred no fewer than 26,144 men to ports within daily travel distance.

It was desirable that they should explore the possibilities of distributing their labour reserves on some basis better adapted to the needs of the moment, and that enquiry was now in hand. It was interesting to find that one port authority had had the enterprise and imagination to apply their own remedy. They had built up a substantial local reserve of labour adequate to their needs by keeping their transferees after the immediate need for them had subsided, knowing that they would soon be needed again. The result was that the men had settled down—some had even transferred their homes—and that the requisitions from that port had been reduced to only about one-sixth of what they would otherwise have been. That pointed a way to a solution.

Problem of Labour Control

The Corporation had had its fair share of teething troubles, and he was not going to pretend that they had yet found the right method of dealing with the very difficult problem of labour control. Ultimately the solution would be found in developing among the general body of workers a higher sense of responsibility as a correlative of the benefits of the privileged position they enjoyed under the scheme. It was a problem which called for the co-operation of both sides of the industry, and above all for wise and courageous leadership by the unions.

Welfare Work

On the question of welfare, the chairman said that it was a term capable of a variety of interpretations, but it was a matter which was securing an ever-increasing importance in industrial importance. Port transport workers had probably been the most ill-provided class in the country. They were nobody's children. Being casual workers, engaged by one employer to-day and by another to-morrow and by none the next day, it was nobody's business to look after their welfare. The directors had taken the view that a responsibility rested on the Corporation in that sphere, and they had made a beginning by appointing to the staff an officer whose function it would be to devise and carry out an appropriate programme.

Post-War Reorganisation

Turning to post-war industrial reorganisation, the chairman said that in most of the discussions it seemed to be agreed that what was described as " organised labour " must be brought into closer touch with the direction of industry, and from that aspect the Corporation, with its boards composed in equal parts of representatives of the two sides of the industry, must be of interest to everybody who was thinking about the problem. As pioneers in the field, a responsibility rested upon them to show that the labour and management sides of industry could both associate successfully in the direction of an undertaking. The position was not an easy one. Each side must be prepared for some sacrifice of their sectional outlook and recognise that the interest of the part can be reconciled and merged within the greater interest of the whole.

Fig. 1. Construction of Graving Dock in the Dry. Enclosure Dam.

Graving Dock for United States Navy built Offshore in the Dry

By Capt. E. C. SEIBERT (C.E.C.), U.S.N., Officer in charge of construction.

A graving dock, recently under construction at one of the United States Navy Bases, included features of interest, not only because of its size (150-ft. by 1,100-ft.) and unusual pumping and flooding arrangement, but also because it was constructed "in the dry," using deep wells to control underground water, aided by well points in the side slopes. The use of deep wells in this way is believed to be without precedent in size and boldness of the operation, and bids fair to establish a new mode of attack on graving dock construction problems.

The curved head of the dock is practically tangent to the former beach line while the dock entrance lies outside at a distance of 1,100-ft. where water depth was 18-ft. to 20-ft. when the work started. Thus the dock was built in what was originally sea area. Protection of the dock from the sea is afforded by a breakwater 2½ miles offshore.

The underside of the concrete floor of the dock is 60-ft. below M.L.L.W. Above that elevation are sand, silty loam and clay streaks; below it there is a 50-ft. to 60-ft. bed of sand, fine to coarse, underlain by a 15-ft. to 20-ft. layer of silty loam and clay streaks, which in turn rests on a coarse water-bearing sand and gravel of very considerable depth (Fig. 2).

Exploratory Work

By means of a test pit some 50-ft. deep, sunk near the dock site with the aid of well points; through the use of test pumps; with observations during pumping, of ground water levels at appropriate locations (using observation wells or pipes driven into the ground and jetted out to free them of earth); and with laboratory analyses of the various earth materials from the site, data were obtained on which to base estimates of the quantity of water that would have to be pumped to dry out the excavation for the dock after its enclosure within a dyke. The amount of water that actually had to be pumped in the unwatering operation was of the order of 25,000 to 36,000 gallons per minute, checking closely with advance estimates.

*Reproduced by permission from "Engineering News-Record" of New York.

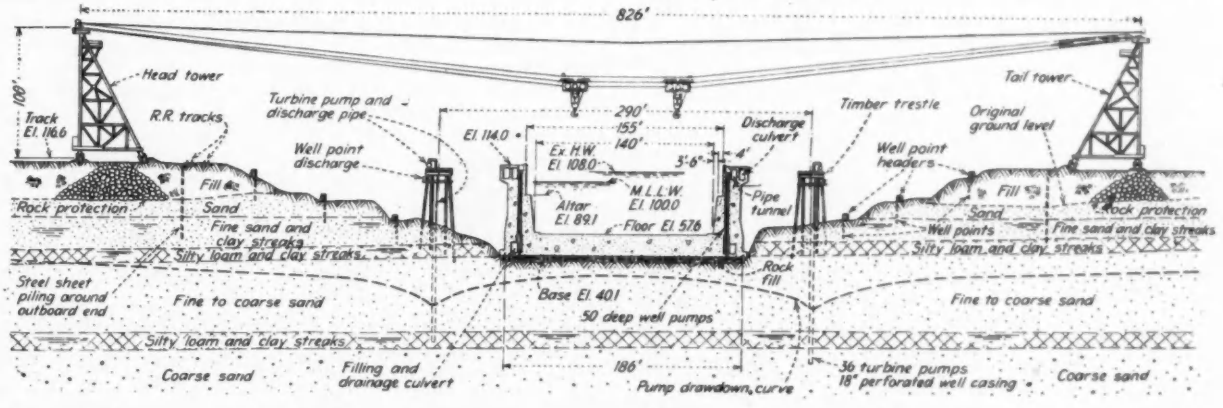


Fig. 2. Section across dock site. Entire area was under water when work started. Note: "Original ground" level indicated at extreme right.

Graving Dock for United States Navy—continued

Excavation to the elevation of the underside of the floor, namely, to a depth of 60-ft. below M.L.L.W., was done with a floating hydraulic dredger. During dredging a protective rock sea wall (Fig. 2) was placed around the site, except for an opening through which the dredger and other floating equipment could later be removed. After dredging, floating equipment was used to construct a timber trestle entirely around the site of the dock, and from the deck of this structure, 36 gravel-packed deep wells, 30-in. in diameter, were put down with rotary well-drilling equipment.

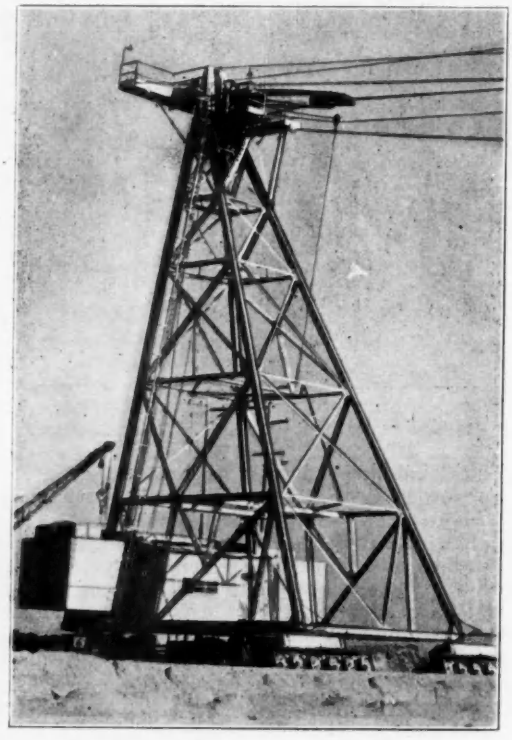


Fig. 3. One of the four travelling towers that support cableways of 826-ft. span and 100-ton combined capacity.

Pumping Equipment

Most of these wells, spaced beyond and around the site of the dock proper, were sunk deep enough to pierce the layer of silty loam and clay streaks some 15-ft. to 20-ft. thick. (In some cases loss of circulating mud in drilling the wells obscured the data but it appears that 6 to 9 of the wells stopped short of the clay layer). The clay layer was pierced as a safety measure to relieve hydrostatic uplift on this stratum believed to be more or less impervious. This, despite the fact that computations indicated a sufficient weight of material above tc more than balance the hydrostatic uplift (Fig. 2).

In each well was sunk a 2,000 gallons per minute pump and submersible motor. The water was piped from the top of each well, through a check valve, into headers, one down each side of the trestle, discharging overboard beyond the bounds of the work.

Pumping out the Pool

In addition to the 36 deep well pumps, two pumps, each of 6,000 gallons per minute capacity, were placed on the trestle to pump sea water from the pool enclosed by the dyke. Pumping was started on a certain date, and six weeks later, the 60-ft. excavation had been completely cleared of water. After each few feet of progress in lowering the water in the pool, pumping was moderated or stopped to allow the banks to drain.

Through percolation, the pumping of the deep wells affected the pool level. The well water was tested for salinity from time to time, and generally showed a salt content about one-third that in sea water outside the dyke.. Even after complete unwatering of the pool there is some salt content in water pumped from the deep wells.

When the trestle had been completed, the floating equipment was removed and the opening in the rock wall closed. Concurrently with construction of the trestle, hydraulic fill was placed along the sides of the rock wall, and a fleet of trucks, loaded by drag lines with sand dredged from the borrow areas, aided in completing the rock wall into a dyke entirely inclosing the site. This dyke completely covers the original rock breakwater except on the ocean end of the dock, where dumped fill was deposited on the inner but not on the outer side of the enclosing rock wall since sea action would have soon carried it away. Finally, as an additional safeguard, a steel sheet pile cut-off wall, with piling all 60-ft. long, and with its top tied by means of rods to the outer rock wall, was driven just inside the rock wall across the outer end. This piling extended across the exposed-to-the-sea portion of the enclosing dyke, and returned for suitable distances along both sides of the enclosure, thus almost completely shutting off percolation from the sea.

The maximum rate of pumping from the wells totalled about 36,600 gallons per minute. Five weeks after pumping started, it dropped to 28,000 gallons per minute at which time the ground water at the dock site was indicated, by a line of observation wells along the longitudinal centre line of the dock, to be 10-ft. to 20-ft. below the elevation of the bottom of the dock excavation.

Other observation wells for studying ground water action were located in a 4,000-ft. line extending to westward of the dock site. The pumping rate had decreased to about 26,000 gallons per minute at a time when about two-thirds of the bottom slab of the dock had been poured. These figures indicate that the installed pumping capacity was roughly double that which pumping experience showed to be necessary.

Well Points in Side Slopes

As the water in the excavation was lowered, well points (usually with 24-ft. risers) were placed, on about 4-ft. centres, to stabilise the banks. In all, about 1,600 points were used, in three lines, in locations as shown in Fig. 2. The well points produced a maximum yield of about 2,000 gallons per minute.

The location and number of well points were not predetermined; they were placed, partly by experiment, where they were found to be needed, and where they produced the greatest yield.

For the best results, the well points had to be gravel-packed, occasionally back-washed with water to keep them clear and productive, and had to be so located that their ends were down to, or extended a short distance into, the various shallow-depth clay strata found in the upper formations. These clay strata acted as floors for collecting the downward percolation through the more-or-less porous materials above.

In putting down a well point, a pipe was first driven by means of a small pile driver rig; this pipe was jetted as driven and cleared by means of the jet. After the pipe had been cleared the well point was introduced, gravel was poured into the space surrounding it, and finally the pipe was withdrawn, leaving the well point in a nicely-packed gravel wall well.

Two relatively small bank slides occurred before the dry dock area had been completely closed off from tidal effects. These were not of serious extent, and the areas involved were refilled and stabilised with gravel. Local wet spots in the banks were stabilised by gravel coverings. Gravel thus placed acted in the same manner as a " French drain " and prevented washing away of the finer particles in the banks. Where a leak occurred through the interlocks of the sheet pile cut-off, gravel was banked, with appropriate drain pipes to carry off the inflow.

A study was made of the possible effects of the decrease in hydrostatic pressure in and on the underlying strata, to find whether possible ground settlement might affect nearby structures. It was concluded that the effect would be negligible and would not cause damage to any structures in the vicinity. It was noted, also, that upon final completion of the dock and cessation of pumping, the original hydrostatic conditions below ground would be gradually restored.

Graving Dock for United States Navy—continued

Concrete Placing Operations

As soon as the site was cleared of water, the bottom was brought to grade, a gravel layer averaging 1½-ft. thick was spread over it, and forms were set for pouring the alternate transverse blocks for the bottom. Each of these blocks is roughly 18-ft. square in section, 186-ft. long (across the dock), and contains about 2,300 cub. yds. of concrete. The vertical sides of the formed blocks were cast slightly concave, thus forming an effective key with the blocks later poured to fill in.

In 48 calendar days after completely emptying of the dock, the forty-sixth block was being poured, making the total concrete in place, including some portions of the side wall sections, about 100,000 cub. yds. This was about 50 per cent. of the concrete required for the dock.

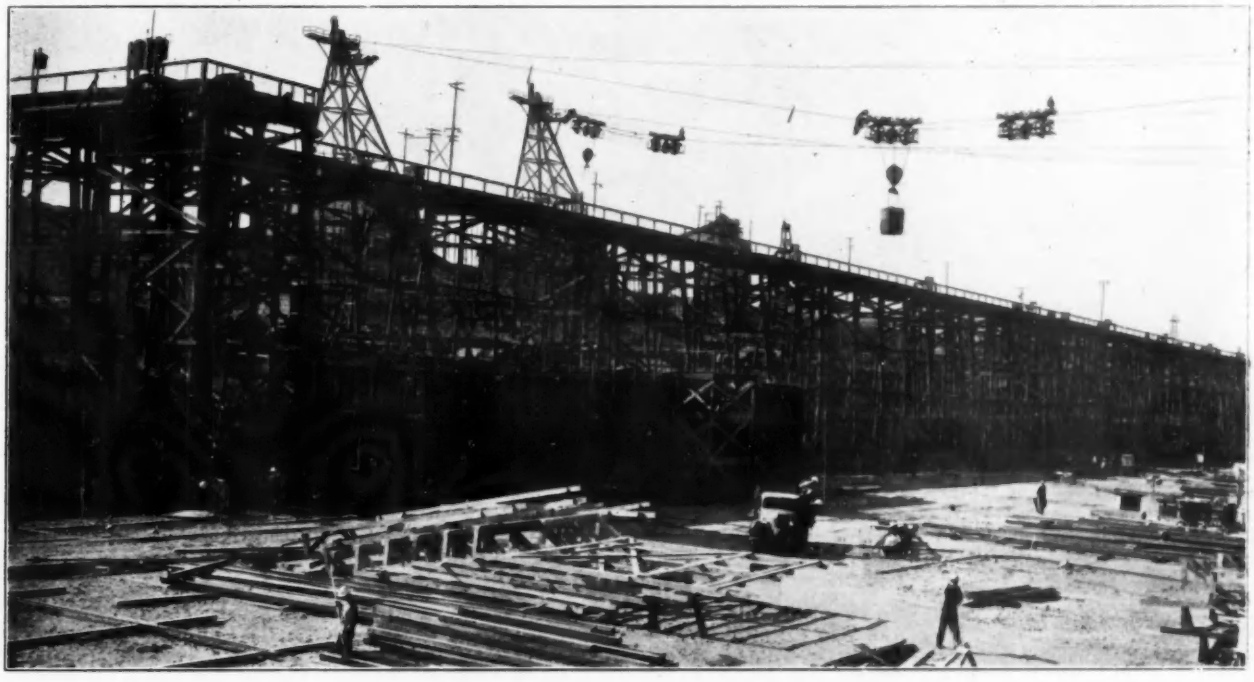


Fig. 4. Construction of Side Walls.

At the mixing plant, concrete from two 4 cub. yd. mixers went directly into 8 yd. bottom-discharge buckets on flat cars (three buckets per car), which were spotted by locomotives under the two cableways spanning the dock.

The cableways were chosen and ordered early in the construction programme, because they would be well adapted to handling the large tremie forms that were part of the original plan. At that time, the intent was not to clear water first; concrete forms were to be lowered through the water to the bottom, complete with reinforcing steel in place, for each cross-block of the bottom. Since the later development of a build-in-the-dry plan, the original tremie forms were cut into smaller pieces, two to a side, and were easily handled and placed by the cableways.

The pipe on the trestle carrying off the discharge from deep-well pumps has been utilised as a convenient and economical source of curing the water for all concrete surfaces.

Advantages of Small Pumps

A call for bids on large pumps of conventional type for emptying the dock when in use in docking ships showed that high cost, as well as delayed and uncertain deliveries, made it highly desirable to find some better method of providing permanent equipment. Accordingly a study was made of the use of smaller turbine pumps such as the 36 that have been working satisfactorily in the pumping operation. It was found that 50 such units (only 14 more than were already on hand) could be distributed so as to gain the great advantage of decentralised flow. Such an arrangement also afforded opportunity for servicing individual pump units without interfering with the function of the dock and had numerous operating advantages. Accordingly, this plan has been adopted and incorporated in final plans for the structure.

The pumps and their submersible motors were inserted in vertical pump wells cast in the concrete walls of the dock. At their lower ends these walls communicated with a bottom culvert extending entirely around the dock. This culvert is both an inlet and an outlet channel. It receives water from the dock through drains and connecting passages in the floor and it also has gates on outer ends that communicate with the sea. When these gates are open, sea water passes through the culvert into the dock by way of the drains in the floor. Under this plan, inflowing water is dispersed over a wide area in the dock, thus doing away with strong water currents that might displace blocking during filling.

The steel caisson or gate used for closing the entrance of the dock when it is to be emptied of water, was erected on the dock floor and " launched " when the dock was flooded for the first time. This took place when the dyke was removed from the entrance to the dry dock.

Summary

The pumping out scheme of dry dock construction used in this instance bids fair to establish a new mode of attack, in applicable cases, to graving dock construction. Although the method involves uncertainties, these can be reduced by devising means to assure a tight and stable enclosing dyke and by control of water pressure in deep underlying strata to prevent flow into, and uplift of, the bottom of the excavation. This method, the author believes, can be the means of saving many months in construction time and a very considerable amount of money as compared to the indicated conventional means of placing at least the bottom by tremie. Moreover, building in the dry insures a better quality of concrete.

Before the pumping out method can be safely applied, much advance information must be obtained. Studies that should be made include geological investigation, borings, pumping and laboratory tests of samples to determine flow or percolation rates. If it is determined in any given case that the water can be economically

Graving Dock for United States Navy—continued

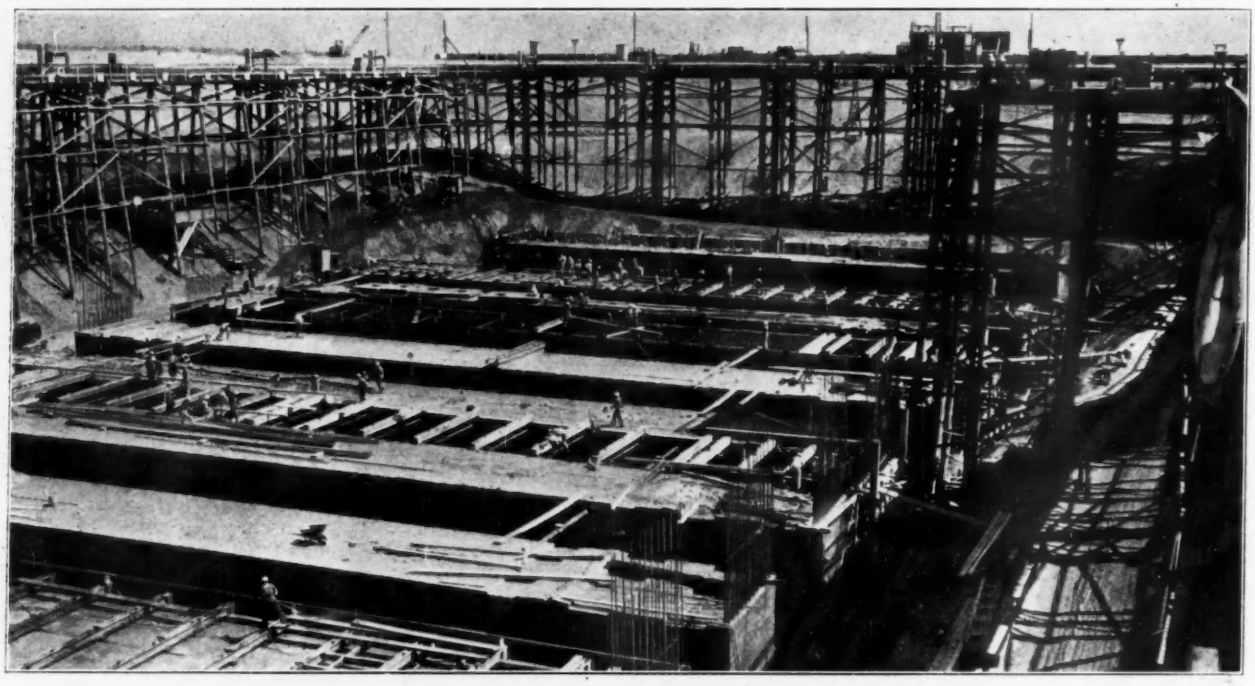


Fig. 5. Shuttering for Alternate Bottom Blocks.

pumped out at a rate faster than the percolation or infiltration rate, the use of the method appears feasible.

Organisation

The Navy Base establishment, including the graving dock, was constructed under a contract awarded by the Navy to Guy F. Atkinson Co. and George Pollock Co. The dry dock was designed by the Bureau of Yards and Docks, United States Navy Department, of which Rear-Admiral Ben Moreel (C.E.C.), United States Navy, is chief. The writer is officer in charge of construction. Lt. W. L. Painter (C.E.C.), U.S.N.R., is head of the construction section of the Navy office and Nathan Karp, civil engineer in the Navy office, has made or checked many of the computations.

Port Traffic and Post-War Planning

Views of Traffic Expert

Reproduced below is a report* of an address recently delivered at a meeting of the Yorkshire Traffic Association, by Mr. W. H. Gaunt, C.B.E., M.Inst.T., President of the Mansion House Association on Transport, a member of the Transport Advisory Council and other bodies.

Mr. Gaunt touched on some current problems and referred specially to the vital necessity of post-war planning, including ports. Regard he said, must be had to a sense of proportion about the reconstruction and replanning of the country, and there was no better work to which business men could apply their thought at the present time.

With regard to traffic diversion, he emphasised that there was a big difference between this war and the last one, and unless it could be guaranteed that there would be no war in future, or at least for about a hundred years, we could not afford to allow England to resume the same traffic shape that it possessed in 1939.

Under present conditions it would not be wise to rebuild everything that had been knocked down all over the country and particularly in those places on the East Coast. Incoming traffic must be diverted to the West Coast ports so that they could get over the tremendous congestion there was during the first two or three years of war on our ports.

There were alternative suggestions. Until 1939 the ideal method, which we felt safe in pursuing, was to have each deep-water port surrounded by housing and a considerable amount of industrial property. Experience had shown that such ports were the most vulnerable targets possible for air attack. It had taken us over two years to construct inland warehouses away from the ports. Unless, therefore, someone could guarantee immunity from war it was preferable to concentrate on a larger number of smaller deep-water ports on the West Coast, or should there be a canal across Scotland, to obviate the dangerous voyage around the north of Scotland?

Were they also going to be content with two or three comparatively weak railways or should they encourage railways with vastly improved communications between the north and the south? These were matters of moment to which the most serious thought should be given.

*Taken from "The Contract Journal," 25th November, 1942.

Fusion of Welsh Dry Dock Companies.

The directors of the Prince of Wales Dry Dock Company, Swansea, Ltd., and of the Port Talbot Dry Dock Company, Ltd., have announced that negotiations have been completed whereby the Prince of Wales Company will offer to acquire all the shares of the Port Talbot Company on the basis of exchange of one Prince of Wales 10s. share for each £1 Port Talbot share. The offer is contingent on the acceptance of holders of not less than 75 per cent. of 100,000 issued Port Talbot shares, or such less proportion as the Prince of Wales Company may determine and on that company making the necessary increase in its capital.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export.

American Association of Port Authorities

Thirty-first Annual Convention at Hamilton, Ontario, Canada

Press reports of the meeting in September last of the American Association of Port Authorities at Hamilton, Ontario, delayed in transit, came to hand too late for inclusion in the December issue of this Journal.

The following curtailed particulars of the proceedings are extracted from *Traffic World* of September 12th and 19th, 1942.

Problems of keeping ports "fluid" in war time occupied the attention of the members of the American Association of Port Authorities for most of the first day of the thirty-first annual meeting of the Association at Hamilton, Ontario, September 10th. Both speakers at the morning session dwelt on port protection.

Mr. John M. Wilson, Toronto, President of the Association, called the convention to order, with most of the 87 registrants in their seats. The invocation was by the Right Reverend L. W. B. Broughall, D.D., Bishop of Niagara, Mayor C. V. Langs, K.C., of Hamilton, made an address of welcome, and there were responses by Mark H. Gates, San Francisco, for members from the United States, and B. J. Miller, Toronto, for members from Canada.

President Wilson, in his annual address, said that, because of war conditions, much of the work of the members of the Association could not be described. Those conditions had also curtailed the activities of the Association's Committees, he said, but they had "done their best under the circumstances," and he made no apologies for them. There had been hesitancy about holding an annual meeting, he said, but it was felt that, through this meeting, the Association could make a "worth-while contribution to the cause of freedom that would offset the time and travel expense involved."

The report of the secretary and treasurer, **Tiley S. McChesney,** New Orleans, Louisiana, said that the war had materially cut down the foreign correspondence of his office, but that he had "been kept quite busy responding to enquiries and caring for general correspondence." The Association, under the direction of his office, had issued a directory of port authorities and terminal operators in North America in the year, he said, and the income from sales of the volume would eventually more than cover the cost of the project.

Present total membership of the Association was 153, his report showed, and its balance as of July 31st of this year was $7,215 as compared with $6,966 on October 1st, 1941. His report and that of the president were accepted.

Coast Guard Port Protection

The first speaker at the session was **Rear-Admiral Stanley V. Parker,** United States Coast Guard, who read an address, prepared by **Vice-Admiral R. R. Waesche,** on "Protection of Harbours and Waterfronts by the United States Coast Guard." Vice-Admiral Waesche sent a message saying that weather conditions had prevented his being present.

It was appropriate that he should describe to a mixed audience of Americans and Canadians the activities of the United States Coast Guard in the protection of the harbours of the United States, said Admiral Waesche, since both groups had the same problems and "both" have exactly the same goal—victory for the United Nations." In peace-time, the United States Coast Guard had built a close relationship of goodwill and team work with the Canadian authorities in law enforcement, ice patrols, prevention of smuggling, fisheries conservation and shipping safety, he said, and the boundary between the two countries seemed "like an imaginary line."

Although the Coast Guard had now assumed its traditional war-time military role, its duties as a "maritime policeman" were not abrogated but intensified, he said, continuing:

"However, war means more than the physical combats that to-day are being waged throughout the world. It is one of production; of ships, tanks, planes, munitions and food supplies; of transportation so as to get supplies and weapons to the fighting men of the United Nations wherever they may be, and no less important is the problem of moving these huge stores of material swiftly and safely for as unwarlike as it may sound, safety is a primary military factor which starts on the assembly line or work bench and needs prominent tagging until the article reaches its destination. Particularly it is the safety of our ports and of the material moving through them that you gentlemen, I know, are interested in—a problem which you are striving to meet with all the resources at your command. And it is a problem and a task to which we of the Coast Guard are directing our full energies.

"The steps leading up to the assumption of this duty by the Coast Guard have been ones of progressive development both in respect to authority and responsibility. The fact that the Coast Guard to-day is charged with the security of the ports of the United States finds its logical source in that the primary peace-time duty of the Coast Guard is as a maritime policeman. And like any successful policeman, it has discovered that prevention is the best cure."

Canada and the United States were training the world's finest fighting men, and there was "no question about the production of the necessary war materials," he continued, but the immediate problem was "to transport those men and materials to the remote battle fronts where they can best be used." To get them there, they had to pass through some port, he said, and it was the job of the port authorities and the Coast Guard "to ensure that nothing be done to interfere with their free flow."

There had to be a balance of opposing forces to protect the ports, on the one hand, and maintain "optimum operating efficiency," on the other, he said. He described the organisation of Coast Guard port protection, with a captain of the port in charge of each port area, "directly charged with safeguarding all vessels and waterfronts within the territorial limits set forth in his orders." The captain of the port was charged with the enforcement of Navy and Coast Guard orders, he said, but, in addition, he had "a broad discretion in instituting local regulations made necessary by conditions peculiar to the port."

Every person entering a dock or pier in the United States port had to carry an identification card, but he stressed the fact that such cards were merely for identification and not passes. Operators of facilities were being urged to institute a uniform pass system, he said, and to issue such passes only to those holding Coast Guard identification cards. On the water side of piers and docks, he said, the Coast Guard was maintaining water patrols "so far as limitations on men and equipment permitted," and small vessels were forbidden to approach within a hundred feet of war installations and freight piers without special licenses from the captain of the port.

He spoke about the work of the Coast Guard in waterfront fire prevention and fire fighting. Underwriters organisations had been enlisted in the prevention work and Coast Guard personnel was being trained in a newly organised fire prevention school. Another special school was training men for the operation of 250 fire boats, purchased by the Coast Guard, and trained firemen were being enlisted in the Coast Guard with petty officers ratings. All this, he said, was not intended to supplant but to supplement existing municipal fire prevention and fighting.

The Coast Guard was charged with the enforcement of regulations governing the loading and unloading of explosives. Incidental to this and the other work of the Coast Guard, captains of ports and district officers had power to deny access to and to remove from vessels and waterfront facilities "all persons whose presence thereon is believed by such officers to be inimical to the national war efforts." No such removal, he promised, would "be based upon bona fide labour activities." A procedure had been set up for appeals from such removals to ensure "a just and unprejudiced handling of each case."

The demand for protection by private interests was far beyond the capacity of the Coast Guard to render, he said, and such interests were urged to continue and build up their own groups of private guards. To assist in this, he said, the Coast Guard had set up a temporary Coast Guard reserve in which the private guards would be enrolled and placed under "military control and discipline." The reserve was still in its formative stage, but promised to be successful, he said. He also spoke of such auxi-

American Association of Port Authorities—continued

liary protective efforts as that represented by a Philadelphia regiment of port security volunteers. This organisation was under military control, and had proved its usefulness. He hoped the idea would spread to other ports.

Trouble on the waterfront, whether by fire or accident, he said in conclusion, could be just as destructive as attacks on shipping by enemy submarines and the port authorities and the Coast Guard together were performing a war duty in the safeguarding of the ports.

Arthur G. Slaght, K. C., Attorney, a mmeber of the Dominion Parliament, and a special assistant to the Dominion Ministry of Justice. spoke on "Port Security in Canada." A recent tour of Great Britain, as a member of a parliamentary committee, he said, had taught him many things about the attainment of military security of ports. He strongly advocated the use of barrage balloons in such protection and urged his hearers, both in Canada and the United States to work for the universal use of those devices in port localities. Invasion forces could not land on beaches, he said. They would have to make their entrances through ports, and complete protection of those areas would make invasion impossible. He gave examples of ports in the British Isles that had been badly damaged by aerial attack before the installation of balloon barrages, but had been practically immune from attack since their installation.

He also spoke of sabotage from within, citing numerous examples from the first World War, and praised the American F. B. I. and the Canadian Mounted Police, which had already done much to eliminate danger from paid German and Japanese agents.

War Transport Agencies.

Four speakers, representing the United States and Canadian Governmental war transportation agencies, took the whole of the second day's session. They included, besides **Henry McCarthy,** who read a Paper on "War-time Organisation of Rail, Water and Highway Transportation in the United States," Major **General Charles P. Gross,** head of the Transportation Corps, United States Army; **Richard M. Bissell, Jnr.,** economist, War Shipping Administration, and **Capt. L. Aikman,** Director, Operating Department, Ministry of War Transport of the United Kingdom.

General Gross' address, entitled "The Army's System of Transport Organisation," was delivered in executive session, with the audience under pledge not to disclosed the information it contained.

Mr. Bissell described in detail the problems before the War Shipping Administration and the principles on which it was basing its attack on those problems. "Bottleneck" was a term frequently used in the war effort, he said, but of no one factor was it more descriptive than of ocean shipping. The W. S. A. functions, he said, were divided clearly along two lines—those of ship control and allocation, and those of ship operation.

As to control, he said, the administration was proceeding on the conviction that allocations were to be made with the war needs first in mind, but that that did not mean that civilian shipping was being neglected. Although by far the greater proportion of cargo space was being allotted to American army needs and to lease-lend materials, some of it had to be reserved for civilian traffic to Latin America, Great Britain, the Dominions, and Russia. He pointed out that foodstuffs for the peoples of those lands and other essential American exports had to be furnished as a secondary factor in the war effort. The people of Britain had to be well fed to maintain their production efficiency, he pointed out, and British war industries had to have American raw materials to continue production. South America had to have coal from the United States in order to continue exporting to the United States needed manganese and iron ore, and supplies of meat to Britain and other countries.

Generally, he said, allocations were made on import needs, not on the basis of exports made merely to maintain the non-war economic positions of the exporting countries. He also pointed out that the rule was to import into the United States only essential commodities, even when space on returning vessels was available. There had been objections to the return of ships under ballast when they might have been loaded with non-essential civilian commodities, he said, but there was ample justification in such a policy in the elimination of the added turn-around time required to load and unload such commodities.

He stressed the need for ample storage space at wharfs. There was danger, he said, in keeping freight for export too far away from the ports. Some of the allied nations, he pointed out, believed in keeping considerable "banks" of cargo at ports "on wheels" to provide supplies close enough to shipside to ensure immediate loadings. Such wants could be satisfied with storage space strategically placed for rapid cargo loadings, he said.

Ship Loading for Convoys

Captain Aikman described difficulties encountered in loading ships as parts of convoys. Such loadings had to be timed to convoy schedules, he said, in order to eliminate days of waiting time after loading.

He said that the main difference between port practices in peace and war time was that, in peace time, ships moved to points where cargo was available, whereas, in war time, cargo moved to points where ships were available. As an example of the latter, he cited the movement by rail, from Western Canada to the Eastern ports of lumber formerly loaded for European destinations by ship via the Panama Canal. The increasing load carried at the Eastern Canadian ports had created new and vexing labour problems, he said. New men had to be trained with the result that the average daily tonnage loading of stevedore crews had declined. The work fluctuated greatly, so that, in intervals between peaks, men "filtered away" into other industries. The stress of the work also meant the use of much penalty overtime labour, which placed heavy financial burdens on contractors and agents.

The speaker said he saw only two ways out of the difficulty—either the government would have to appropriate money to reimburse the contractors and agents, or ship labour would have to be conscripted.

He described new methods of ship repair that had been set up to put back in service as rapidly as possible ships damaged in accidents or in military action. These included the pooling of such integral parts as winches, so that new ones could be installed and the damaged units removed for repair and placement on other vessels, and new salvage regulations.

New Officers

Finley W. Parker, Galveston, Texas, reported as chairman of the nominating committee. All of the recommendations of that committee were accepted with the result that the following officers and board members were elected:

President, Mark H. Gates, San Francisco, California; First Vice-President, Walter P. Heddon, New York; Second Vice-President, R. T. Spangler, Fort Lauderdale, Florida; Third Vice-President, K. J. Burns, Vancouver, British Columbia; Secretary and Treasurer, Tiley S. McChesney, New Orleans, Louisiana.

Members of the Board of Directors: E. R. Cox, Philadelphia, Pasadena; R. J. Dempsey, Newark, New Jersey; W. C. Paxton, Norfolk, Vancouver; G. H. Pouder, Baltimore, Maryland; T. H. Banfield, Portland, Oregon; George Osgood, Tacoma, Washington; J. Russell Wait, Houston, Texas; E. O. Jewell, New Orleans, Louisiana; C. E. Sauls, Mobile, Alabama; L. W. Adams, Corpus Christi, Texas; F. W. Parker, Galveston, Texas; P. J. Mulqueen, Toronto, Ontario; R. K. Smith, Ottawa; G. H. Moore, Los Angeles, California; Eloi Amar, Long Beach, California; Ralph W. Hendry, Halifax, Nova Scotia.

Mr. Gates was elevated to the presidency from the second vice-presidency. C. U. Smith, Milwaukee, who was first vice-president, resigned recently because of his withdrawal from port work.

The board of directors met immediately after the close of the convention and re-elected Mr. Osgood, Mr. Parker and Mr. Hedden to the executive committee. It also considered an invitation from Boston for the 1943 annual meeting, but left the selection of the place and the question as to whether or not to have an annual meeting next year to future decision by the executive committee.